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CITY WIDE STUDIES

PART II

THE PLANNING OF PUBLIC SERVICES



CITY OF NEW YORK

1934 - 1938

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CITY-WIDE STUDIES
PART II
THE PLANNING
OF
PUBLIC SERVICES
FOR THE CITY OF NEW YORK



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Under Sponsorship of the
MAYOR'S COMMITTEE ON CITY PLANNING
of the City of New York
1940

FIORIELLO H. LAGUARDIA, *Mayor*

³ Succeeded John F. Galvin, deceased July 1936.

CITY-WIDE STUDIES — PART II
THE PLANNING OF PUBLIC SERVICES
FOR THE CITY OF NEW YORK

FOREWORD

The reports published herein belong to a series, prepared for the Mayor's Committee on City Planning of the City of New York, covering studies made during the years 1934-1938 with the aid of the United States Work Projects Administration Project Number 465-97-3-96.

For a general statement of the purpose and methods of these studies the reader is referred to the Preface to Part I of these City-Wide Studies.

The entire series reports upon one of the few recorded efforts to conduct comprehensive city planning studies in this country. Part I "Basic Factors in the Planning of the City of New York" includes population, industrial and residential areas, and zoning reports. This part reports upon those public services that must be studied in the planning of the city and in the programming of city expenditures for permanent improvements. Part III "Programming Public Improvements in the City of New York" examines the city's ability to finance permanent improvements in the future, and suggests a long-term outlay program for needed public works within the financial resources indicated.

Purpose

At its inception in 1934, the staff of the Mayor's Committee on City Planning was directed, among other things, to lay the ground work for a master plan through the relevant city-wide studies, and to consider municipal finances in connection with public works planning. Provisions of the present charter, which was adopted in 1936 and became effective January 1, 1938, gave especial emphasis in these studies to a long-term program of permanent improvements that would provide for the city's indicated future development.

Accordingly the studies of Highways, Water Supply, Sanitation, Education, Parks, Rapid Transit, and Other Public Services attempted to ascertain current deficiencies and probable future needs during three six-year periods for all public services which are related to the master plan and the scheduling of city expenditures for permanent improvements.

The reports included in this part were completed at the various dates mentioned in the several chapters. Changing conditions have subsequently modified some of the data upon which these studies were based. In editing the original manuscripts for publication, it was not practicable, however, to undertake the revisions necessary to bring the studies up to date.

Method

It was impracticable for the staff to attempt detailed studies of individual projects in all fields. In several studies, therefore, future needs were measured on the basis of the population of 9.2 millions expected in 1970, distributed according to the pattern envisaged in the Residential Area Study. With the exception of population forecasts, all data employed in these studies were obtained from official sources,

One of the more difficult problems encountered was the determination of the extent of improvements that will be required for the replacement of that portion of the existing physical plant that may become inadequate or obsolete during the eighteen years 1939 through 1956. Such needs are not readily ascertained in studies dealing with city-wide problems of the magnitude found in New York.

Whenever the information that would indicate the extent of such requirements was not available, the staff relied upon past per capita expenditures as an indication of future needs. Since the costs of the extension and replacement type of improvement are, in general, relatively small this method was considered fairly satisfactory.

The assumptions employed in these studies were believed to be reasonable on the basis of available data, but they are obviously subject to qualification.

Acknowledgments

General acknowledgments are included in the Preface to Part I of the City-Wide Studies written by Mr. Lawrence M. Orton, who was Secretary of the Mayor's Committee on City Planning. Unfortunately it is not possible to mention all members of the staff who played responsible parts in the several studies. Mr. T. T. McCrosky, who served as general consultant, collaborated in the development of techniques in the Education and Park Study, and is author of the chapter on Parks. Mr. William W. Forster, author of the chapter on Highways, was directing consultant of the Highway Study, assisted by Mr. Robert C. Weinberg. It is also a pleasure to express my appreciation to Mr. Frank J. Klopff, Project Engineer, to whom a large measure of credit is due for the effective organization and supervision of the staff; to Mr. Ahlin Kingston, Supervisor of City-Wide Studies; and to the other members of the project staff who assisted in these investigations.

Grateful acknowledgment is made to the United States Work Projects Administration, without whose material resources and cooperation these studies could not have been undertaken; to the Board of Education of the City of New York, in the reproduction of this report; to the Spelman Fund of New York and the Regional Plan Association for ensuring skilled direction for the work; and to the many public agencies that made essential information available to the staff.

Finally, I wish personally to acknowledge the cooperation and aid of the Department of City Planning in the publication of this material.

F. Dodd McHugh
Technical Director

C O N T E N T S

THE HIGHWAY SYSTEM

INTRODUCTION

	PAGE
STANDARDS AND OBJECTIVES	1
ANALYSIS OF PRESENT CONDITIONS	2
ANALYSIS OF PREVIOUS PROPOSALS	2
PRELIMINARY CONCLUSIONS	5
EIGHTEEN-YEAR PROGRAM FOR NEW HIGHWAY CONSTRUCTION	5
A. EXPRESS HIGHWAYS AND PARKWAYS	5
B. MAJOR STRUCTURES AND THEIR APPROACHES	8
C. MAJOR HIGHWAYS	10
D. SECONDARY HIGHWAYS	12
E. SPECIAL INTERSECTIONS	15
LOCAL STREETS	15
SUMMARY OF COST	16

WATER SUPPLY

INTRODUCTION

SOURCES OF SUPPLY	23
Present Dependable Yield	23
Source of Future Supply	23
DEMAND FOR WATER	24
Normal Requirements	24
Without Systematic Waste Control	24
With Underground Leakage Suppressed	24
With Underground Leakage Suppressed and Universal Metering	27
Estimated Future Consumption	27
Without Systematic Waste Control	27
With Underground Leakage Suppressed Alone	27
With Universal Metering Alone	27
With Underground Leakage Suppressed and Universal Metering	27
ECONOMICS OF WATER SUPPLY	27
With Universal Metering and Underground Leakage Suppression	27
Without Systematic Waste Control and Present Methods of Selling Water	28
CONCLUSIONS	31
Conservation	31
Operating Costs	32
Capital Costs	32

C O N T E N T S

SANITATION

INTRODUCTION

	PAGE
REFUSE	37
Ash Disposal	37
Rubbish and Garbage	37
SEWAGE DISPOSAL	37
Present Program	38
Probable Needs	38
Estimated Future Costs	38
OTHER SANITATION IMPROVEMENTS	41
Suggested Capital Outlay Program	41
Probable Future Expenditures	42
SUMMARY OF FINDINGS	42

EDUCATION

INTRODUCTION

POPULATION OF SCHOOL AGE	43
Children Available for Elementary School, 1920-1936	43
Children Available, 5-13 Years of Age, 1936-1970	44
Future Elementary School Registration	44
Children Available for Secondary School, 1920-1936	44
Children Available, 14-18 Years of Age, 1937-1970	47
Future Secondary School Registration	47
REQUIREMENTS FOR ELEMENTARY SCHOOLS	47
Past Registration by School Districts	47
Population of School Districts	48
Future Registration by School Districts	48
Existing School Plant	51
School Plant Needed by the Year 1940	51
REQUIREMENTS FOR PUBLIC SECONDARY SCHOOLS	55
Present High School Plant	56
Future High School Needs	56
COLLEGE FACILITIES	56
Future College Plant	57
INDICATED CAPITAL EXPENDITURES	57
Relation to Capital Outlay Program	58

CONTENTS

	PAGE
SUGGESTED CAPITAL PROGRAM	58
New Elementary Schools	58
New Secondary Schools	58
Additional Appropriations Required	59
Replacements and Relocations	59
For the First 6-Year Period	59
For the Second 6-Year Period	60
For the Third 6-Year Period	60
Eighteen-Year Capital Program	60

PARKS

INTRODUCTION

Types of Park and Playground	63
Cost of Recommended Program	64
EXISTING PARK SYSTEM	64
STANDARDS FOR PARK ADEQUACY	67
ADEQUACY OF EXISTING PARK SYSTEM	68
FUTURE REQUIREMENTS	68
Area and Estimated Costs	71
DISTRIBUTION AND COST OF NEEDED FACILITIES	71
Playgrounds and Athletic Fields	71
Small Quiet Parks	75
Private Park and Playground Areas	77
Additional Large Parks	77
RECOMMENDED PARK PROGRAM	78
REVIEW OF PROGRAM	79

RAPID TRANSIT

INTRODUCTION

THE PRESENT SYSTEM	83
Population Served	83
Concentration of Working Population	84
RIDING HABIT	87
Future Riding Habits	88
VARIATIONS IN TRAFFIC	88
Monthly Traffic	88
Daily Traffic	88
Hourly Traffic	91

C O N T E N T S

	PAGE
TRAFFIC DISTRIBUTION	91
Origin of Rush Hour Traffic	92
Present Rush Hour Traffic	93
Future Rush Hour Traffic	94
Origin of Future Rush Hour Traffic Into Lower Manhattan	95
PRESENT CAPACITY	96
Rush Hour Capacity	96
Capacity Under Peak Loads	99
Future Peak Loads	99
FACILITIES NEEDED BY THE YEAR 1970	100
Improving Existing Facilities	100
New Lines	101
UNIFICATION	103
LINES UNDER CONSTRUCTION	103
DEPRECIATION	104
Depreciation Rates	105
Investment in Rapid Transit	105
Allowance for Depreciation	106
COSTS OF DESIRABLE TRANSIT IMPROVEMENTS	106
Rapid Transit Debt	107
Future Expenditures and Resources	107
The Master Plan and Transit	108

OTHER PUBLIC SERVICES

INTRODUCTION

DOCKS	109
Water Commerce	109
Port Facilities	109
Future Outlays for Piers, Slips, etc.	111
Bulkheading	111
Future Outlays for Dockage and Bulkheading	111
Airports	112
Investment in Airports	112
Future Airport Outlays	112
Ferries and Ferry Slips	112
Past Expenditures for Ferries	113
Future Ferry Outlays	113
Desirable Dock Improvements	113

C O N T E N T S

	PAGE
PROTECTION	113
Police Department	113
Fire Department	114
Correction Department	114
Armories	114
HEALTH	115
Hospital Department	116
Present Hospitals and Future Needs	116
Municipal Expenditures for Hospitals	117
Health Department	119
Welfare Department	120
Suggested Capital Program for Health	120
PUBLIC BUILDINGS AND MISCELLANEOUS	120
Markets	121
Libraries	121
Museums	121
Courts	121
Administration Buildings	121
Miscellaneous Projects	121
Suggested Capital Program	121

TABLES IN THE TEXT

TABLE

1	Summary of Costs for the Eighteen-Year Highway Program	16
2	Express Highways—First 6-year Period	17
3	Major Structures and Approaches—First 6-year Period	18
4	Major Highways—First 6-year Period	18
5	Express Highways—Second 6-year Period	19
6	Major Structures and Approaches—Second 6-year Period	19
7	Major Highways—Second 6-year Period	20
8	Express Highways—Third 6-year Period	20
9	Major Structures and Approaches—Third 6-year Period	21
10	Major Highways—Third 6-year Period	21
11	Estimated Income and Outgo for Water Supply with Universal Metering and Underground Leakage Suppression	28
12	Estimated Income and Outgo for Water Supply <i>without</i> Systematic Waste Control and Present Method of Selling Water	31
13	Children Available, 5-13 Years Old and Public and Parochial Elementary School Registration	44
14	Estimate of Future Children Available and Elementary School Registration	47
15	Children Available, 14-18 Years of Age and Secondary School Registration	48
16	Estimated Children Available for Secondary School and Public and Parochial School Registration	51

C O N T E N T S

TABLES IN THE TEXT

TABLE	PAGE
17 Public Elementary and Junior High School Registration School District 28, Brooklyn	52
18 Estimate of New Classrooms Required for Public Elementary Schools in Each School District by the Year 1940	55
19 Estimated High School Seats Needed by the Year 1945	56
20 Spring Registration in New York City Colleges	57
21 Capital Outlays under the Board of Higher Education from City Funds..	58
22 Indicated Capital Expenditures for Education	59
23 School Districts in Which New Classrooms will be Needed by 1940 for Expected Registration in Elementary Schools	60
24 New Seats Needed by 1945 for Expected Peak Registration in Secondary Schools	61
25 Suggested Capital Program for Education	61
26 Existing Park Area (Jan. 1, 1938) as Related to Population and Borough Area	64
27 Calculated Average Acquisition Cost Per Acre of Additional Small Park and Play Area, by Boroughs	71
28 Additional Area Required for Small Parks, Playgrounds and Athletic Fields Combined, with Cost Estimates	72
29 Number of Additional Playgrounds and Athletic Fields Required, by Boroughs	75
30 Summary of Additional Playgrounds and Athletic Field Requirements by Boroughs, with Estimated Costs	76
31 Percent Distribution of Required Additional Playground and Athletic Field Area, by Boroughs	77
32 Additional Playground and Athletic Field Requirements in Acres per 100,000 Ultimate Population, by Boroughs	78
33 Summary of Additional Small Park Requirements by Boroughs, with Estimated Costs	79
34 Summary of Additional Large Park Requirements Proposed by Regional Plan Association with Estimated Costs Prepared by Planning Com- mittee Staff	80
35 Recapitulation of Additional Park, Playground and Athletic Field Areas Required in Acres, Including Regional Plan Association Proposals for Large Parks	81
36 Total Costs of Recommended Program by Boroughs	81
37 Recommended Distribution of Park Program Cost by Groups of Years 1939-1970	81
38 Present and Proposed Ultimate Park Areas, Including Playgrounds and Athletic Fields	82
39 Population Served by Rapid Transit	83
40 Population Density Within 1/2 Mile of Rapid Transit Lines	84

CONTENTS

TABLES IN THE TEXT

TABLE	PAGE
41 Monthly and Average Monthly Fares	88
42 Maximum Hourly 24-Hour Traffic by Companies	91
43 Origin of Rapid Transit Traffic 7-9 A. M.	92
44 Average Daily and 7-9 A. M. Rapid Transit Traffic	94
45 Origin of Estimated Rush Hour Traffic Into Lower Manhattan	95
46 Rapid Transit Car Capacities	96
47 Estimated Present 7-9 A. M. Capacity	99
48 Normal 7-9 A. M. Capacity of Existing Lines and Potential Capacity with Remedial Measures	101
49 Schedule of Expenditures for Indicated Transit Improvements	106
50 Rapid Transit Debt and All Term Debt	107
51 Commerce of New York Harbor and of the Entire United States	110
52 Ownership of Waterfront of New York Harbor	111
53 Costs of Desirable Dock Improvements	113
54 Costs of Desirable Protection Improvements	115
55 Hospital Construction	115
56 Estimated Costs of All Needed New Voluntary, Proprietary and Govern- mental Hospitals and Miscellaneous Buildings	118
57 Estimated Municipal Expenditures for Hospitals	119
58 Costs of Desirable Health Improvements	120
59 Costs of Desirable Public Buildings and Miscellaneous Projects	122

ILLUSTRATIONS

FIGURE		
1	Existing and Potential Non-Gridiron Areas	3
2	Proposals for Arterial, Major and Secondary Highway System (Key numbers on this map refer to project numbers in text)	13
3	The Water Supply of the City of New York	25
4	Consumption of Water for the Years 1868 to 1935	29
5	Average Daily Per Capita Water Consumption	30
6	Total Average Daily Water Consumption	33
7	Combustible Refuse Collected	39
8	Tentative Plan for Sewage Disposal	40
9	Elementary School Data	45
10	Public Elementary and Junior High School Children per 1,000 Population	46
11	High School Data	49
12	Preliminary Conclusion as to Elementary and Junior High School Needs for Estimated Population of 1970 Determined on the Basis of Class- rooms required for Each School District	53
13	Park Areas in New York City	65
14	Area Served by Existing Parks, April, 1937	69
15	Park Acreage Required by 1970	70
16	Playgrounds and Active Recreation Facilities Required by 1970	73
17	Rapid Transit Lines and Area Served	85
18	Riding Habits on Surface and Rapid Transit Lines in New York City ..	89
19	Total Paid Fares on Surface and Rapid Transit Lines in New York City	89
20	Present Rapid Transit Load Diagram	97
21	Ultimate Rapid Transit Load Diagram	98

The Highway System

INTRODUCTION

City Planning and street planning are often regarded as synonymous. Inadequate and erroneous as this conception may be, it nevertheless suggests that the highway system is very near the heart of the matter, and that one need not labor the importance of the city's street system, or its place in a planning program.

Not only do streets serve as channels for traffic, in which capacity they have become the subject of ever increasing public concern and scientific study, but they also establish the pattern on which the city's land is subdivided for building purposes, providing access to all the resulting parcels of land both public and private. They also constitute a major item in the city's outlays for permanent improvements, and hence need to be carefully studied as an element of any long-term capital outlay program, including both assessable improvements and capital budget items.

It was not the purpose of this study to investigate and report upon all phases of New York's street system. Rather it was undertaken in consideration of the fact that the free flow of traffic between all parts of the city is an obvious necessity whose realization within the city's financial resources will be possible only with the aid of far-sighted planning.

Although a considerable number of improvements have been made since 1927 in New York's highway system, the following quotation from the Highway Traffic report issued that year by the Regional Plan Committee states the essential nature of the present traffic problem.

"The problem of communications in the regional area of New York and its environs is probably the most complicated in the world. This is true not only because the area probably contains the largest population of any area of similar size, but also because of the unusual topographic conditions which break it up in such a manner that it is difficult to provide access between its separate parts, and the greater degree of intensity of use of land in proportion to available street space that exists in New York as compared with other great cities. The complications affect all problems of transportation, but none to a greater extent than that which takes the form of traffic movement on highways and streets..."

In undertaking these Highway Studies, the Mayor's Committee on City Planning recognized that the trend of increasing motor vehicle registration will add, if anything, to the pressing nature of the city's traffic problems, and that an adequate solution can be provided only by a comprehensive and coordinated system of highways designed to meet the requirements of modern automotive transportation. In these investigations the staff considered numerous previous studies and proposals by other agencies, but made original suggestions where none were proposed to date.

The projects presented in this report, however, should be understood to be altogether tentative, and subject to further study and coordination by the appropriate agencies before they are included in the official Master Plan. Their value lies primarily in the fact that each proposal has been considered in relation to a comprehensive system of highways, as well as other features of the Master Plan, and that the system as a whole has been kept within the range of financial practicability indicated by other Studies of the Mayor's Committee staff. The timing of these projects in the suggested eighteen year program will obviously be influenced by the availability of city, state and federal funds. Since the completion of this study in April, 1938, construction of certain of these projects has commenced and some of the proposals have been placed on the city map.

STANDARDS AND OBJECTIVES

In the face of the great variety of street patterns that have been tried in cities here and abroad, and of the chronic inadequacy of most facilities of this sort under the deluge of modern automobile traffic, it is difficult to establish standards of adequacy. Even though there were agreement on ideal standards, the conditions to which they must be applied in built-up cities make their realization so difficult as to render them of little value in practice.

An ideal street system, it is commonly agreed, consists of a combination of radial and circumferential highways so arranged that traffic can flow directly between points of origin and destination, with fairly even dispersion throughout the whole system.

Such a pattern is unattainable in New York, except in a very modified form, due to such natural obstacles as the great bodies of water which break up the city and its surroundings and the existing street and building development of the city. Any attempt to carry out an "ideal" system in its entirety would bankrupt the city.

On the other hand, it must be acknowledged that failure to deal adequately with the problem of vehicular circulation will render the city uneconomic, if not unlivable. Therefore a very simple and practical standard has been adopted, namely that rapid movement along major or express highways should be provided for all vehicles, both passenger and freight, from every part of the city to every other part. The principal purpose of this study was to work out such a major highway system, within the financial resources of the city.

It is too much to expect that these major and express highways will be adequate to meet the demands of traffic at all times. Past experience shows that local streets will have to serve the overflow which occurs at peak hours. But at all other times a major highway system that will provide for rapid and direct movement throughout the city is a reasonable and attainable objective.

Two other tests have been applied throughout, namely: (1) Does the facility in question meet the modern standards of design requisite for the handling of the faster passenger cars and the larger buses and heavier trucks now on the road? (2) Is it financially practicable now, or within the next decade or two? With these objectives and standards in view, a comprehensive study of the city's street system was undertaken.

ANALYSIS OF PRESENT CONDITIONS

Because the city's streets are in the jurisdiction of the five borough governments rather than one agency, there was no single map giving basic information on a comparable basis for the city as a whole. The first step, therefore, was to prepare a "street status" map, on which information obtained from each borough and in the field was reduced to a common set of symbols and plotted on maps of uniform scale, namely 1,000 feet to the inch.

These maps, in color and hence not reproducible, provided the staff with information as to the several legal and physical stages in which the city's streets are found, ranging from those merely mapped, through grading and temporary pavement, to fully paved permanent streets.

Coincidentally, there was prepared a replica of the official City Map at the scale of 4,000 feet to the inch, which was printed and hence available in quantity to the staff and others.

Using the information on the street status map, there was thereupon prepared an Existing Streets map, by the simple expedient of eliminating from the official city map all those streets which have no physical existence on the ground.

This Existing Streets map, also printed at the scale of 4,000 feet to the inch, had the added advantage of showing, for the first time, all the non-existing mapped streets within the city limits. It was therefore of invaluable aid not only in these highway studies, but in other planning studies upon which the staff was engaged as well.

On copies of the appropriate maps, the staff plotted various items of information essential to any comprehensive consideration of the city's highway problems, including:

1. Widths of right-of-way and of present pavement of all existing streets.
2. Existing vehicular structures throughout the city, including bridges, viaducts, tunnels, express highways, etc.
3. Present traffic densities on all highways, based on recent Police Department "Vehicle Flow Maps" showing average adjusted daily peak load.

Although directed primarily toward the major highway system, these studies also included an analysis of the local street system. The results of this study were mapped to show graphically the portions of the city actually developed with the typical gridiron street system; the existing non-gridiron areas; and districts undeveloped as yet, including both those that are mapped and unmapped. This interesting map (Fig. 1) shows therefore both the areas in which the gridiron system has already been abandoned, and those in which other systems of local streets are still practicable.

ANALYSIS OF PREVIOUS PROPOSALS

It is natural that any problem of such general interest as street traffic should have called forth numerous "solutions" in recent years, including many suggestions emanating from voluntary sources as well as from the agencies charged with official responsibility for highway construction.

MAYOR'S COMMITTEE ON CITY PLANNING THE CITY OF NEW YORK

FIORIELLO H. LA GUARDIA
MAYOR



WILLIAM F. BRUNNER
CHAIRMAN

EXISTING AND POTENTIAL NON-GRIDIRON AREAS

1938

- UNDEVELOPED AREAS PERMITTING NON-GRID STREET PLANNING
- DEVELOPED AREAS WITH NON-GRID STREETS
- PARKS
- OTHER PUBLIC AREAS
- CEMETERIES

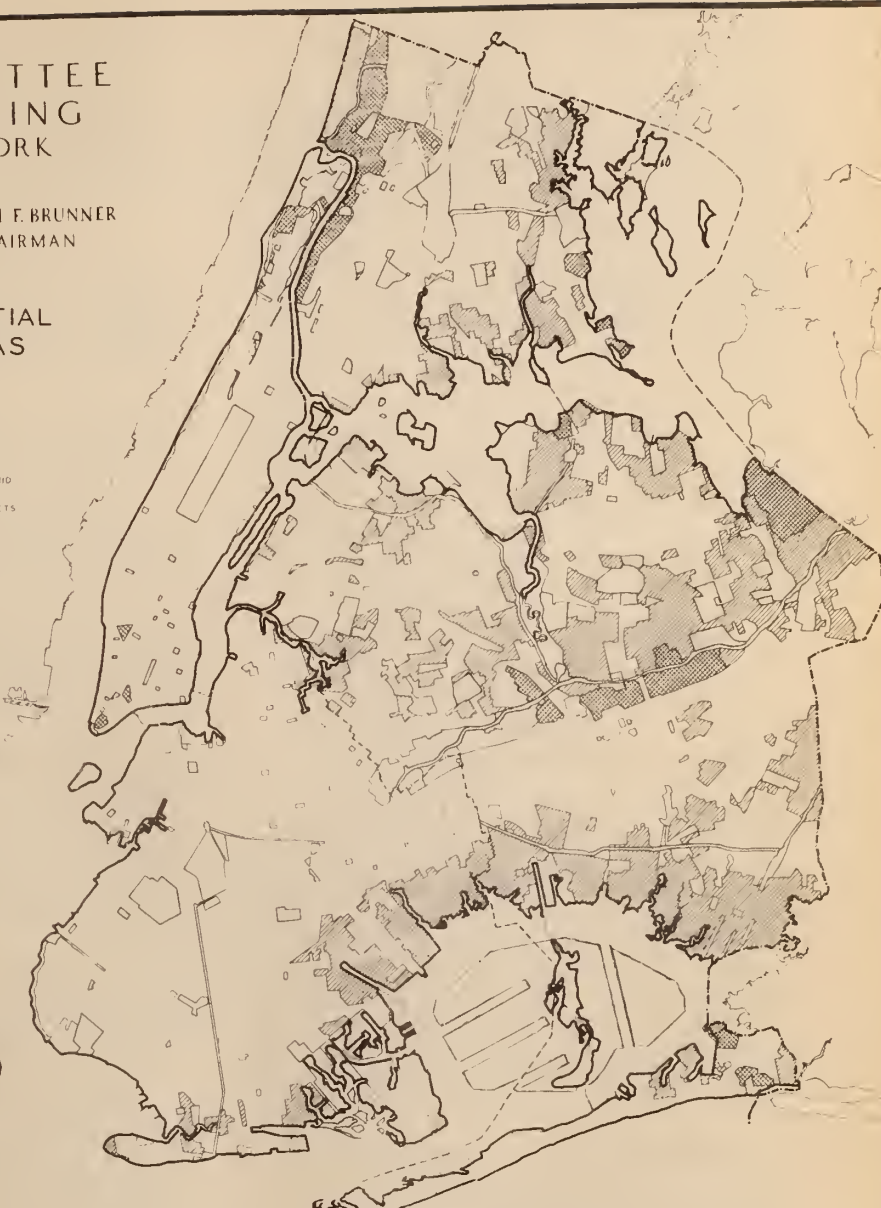
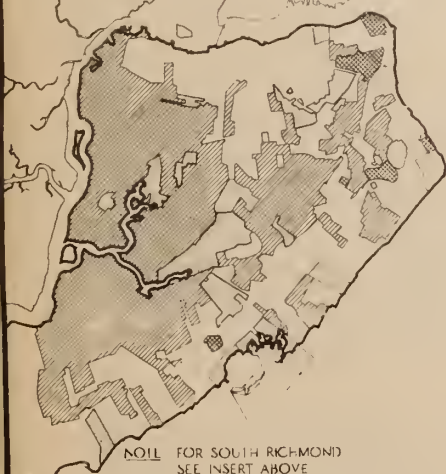


FIGURE 1.

These previous proposals were made the subject of exhaustive study ⁽¹⁾, a complete card file being prepared with an entry for each proposal, including information as to the sponsors and principal endorsers of each project. Such projects included major highways, parkways, bridges and tunnels, as well as more numerous local improvements. They were plotted on maps for study in relation to each other as well as to the other city-wide highway data already described.

PRELIMINARY CONCLUSIONS

Analyses of all these sets of facts and proposals revealed certain obvious and significant conclusions which were of value in the studies for an adequate highway system including:

1. New York's vast network of streets is built predominantly on the inflexible grid-iron system with blocks averaging 200 feet deep and 500 to 900 feet long.
2. There are numerous wide thoroughfares which in many cases fail to function as through arterial highways because of their lack of continuity.
3. Most major structures, the bridges and tunnels necessitated by New York's maritime location, carry enormous volumes of traffic for which their approaches are usually inadequate.
4. Many important streets are seriously handicapped by obstructions such as columns of elevated structures, poor visibility, needless parking and curb loading, and by obsolete design which has resulted in narrow pavements, short curves or angular turns, bumpy profiles and unsuitable paving materials.
5. There are numerous focal points of congestion or traffic knots, at important intersections, at the confluence of several main thoroughfares and at bridges, tunnel and ferry approaches.
6. There are three outstanding regions of traffic density which may be broadly designated as midtown Manhattan, downtown Manhattan and the hub of Brooklyn, where the average speed of vehicles during the day is less than twelve miles per hour. Congestion in these areas is due to

concentration of residence, business or amusement interests in addition to a large amount of through traffic, which at present passes through instead of around these regions.

The proposed highway program resulting from these studies is not considered an ultimate system for the city. Rather it has been confined to what may be practicable for the city to undertake in the next two decades, or more precisely, for three six-year periods. Despite the limitation, it would appear that the city can actually provide itself with a well-rounded, reasonably adequate, highway circulation system within this eighteen-year period, assuming that its parts are properly related, its execution scheduled, and the available funds not spent for other projects or purposes.

EIGHTEEN-YEAR PROGRAM FOR NEW HIGHWAY CONSTRUCTION

Functionally, this program may be divided into five groups of facilities:

- A. Express highways and parkways almost or entirely without grade crossings or traffic lights.
- B. Major structures, vehicular bridges, tunnels and their approaches.
- C. Major highways.
- D. Secondary highways.
- E. Special traffic intersections on existing thoroughfares.

With the exception of group E, these proposals are shown on Figure 2. Preliminary studies and cost estimates have been made for Items A, B, and C, where such data have not been prepared by other agencies. As these projects are of city-wide importance, they are described briefly and tabulated in three six-year periods according to the relative order of importance assigned to them by the staff, together with their costs and possible methods of financing. Items D and E, being of comparatively local importance, are merely enumerated.

A. EXPRESS HIGHWAYS AND PARKWAYS

The first proposals for new construction comprise a system of streamline expressways, practically free from grade crossings or traffic lights,

(1) Among the sources consulted were the following: Official: Board of Estimate, Chief Engineer; Borough Presidents and their engineering staffs; Department of Plant and Structures; Department of Parks; Long Island State Park Commission; New York City Tunnel Authority; New York State Legislative Committee on Highways; Police Department; Port of New

York Authority; State Department of Public Works; Triboro Bridge Authority; and Westchester County Park Commission. Unofficial: Borough chambers of commerce and boards of trade; Day and Zimmerman Report; Metropolitan Conference on Parks (and Parkways); Queens Planning Commission; Regional Plan Association, and other recognized civic associations.

which will connect the city's main approaches and its major centers. The freeways and express highways will carry all types of vehicles; the parkways will accommodate private passenger automobiles only. The proposed super-highway system is expected to accommodate fast moving vehicles that travel relatively long distances, and thus remove this through traffic as far as possible from ordinary streets. Figure 2 indicates facilities designated for general or passenger traffic.

Project No. 1—East River Drive—Manhattan.

Land: \$9,800,000

Construction: \$24,900,000

Length: 8.6 miles

In Manhattan, where the greatest traffic congestion prevails, completion of the East River Drive is the most important project. Instead of the inadequate street which has been partly built, for both through and local traffic and parking, necessitating traffic lights and left turns, continuous separate lanes for fast traffic without grade crossings or lights are recommended. Such a modern streamline highway, permitting uninterrupted flow of traffic, is more favorable for adjoining residential development, affords safer access to recreational facilities, and provides better commercial approaches to the waterfront for tide-water delivery of fuel and building material, and for the disposition of snow and refuse. The cost estimate is for this type of highway.

Project No. 2—Harlem River Drive.

Land: \$4,600,000

Construction: \$10,000,000

Length: 5.7 miles

A logical continuation of the East River Drive will follow along the west bank of the Harlem River from the Triboro Bridge to the present Drive north of 155th Street, with separate pavements for through traffic, connections with existing bridges and a future high level bridge or tunnel to the Concourse, and direct access to the George Washington Bridge by means of the present tunnel under 178th Street, and future tunnel under 179th Street.

At the maximum speed of 35 miles per hour, the non-stop running time on the East and Harlem River Drives will be:

From the Battery to Triboro Bridge.....15 minutes

From Triboro to George Washington Bridge..10 minutes

Construction of the East River-Harlem River Drives as outlined above will greatly speed up north and south bound traffic on the east side of Manhattan, and by providing a suitable highway for fast moving vehicles, will relieve congestion on all avenues east of Central Park, and will make it feasible to lengthen the east-west traffic light interval and thereby also speed up crosstown traffic.

Project No. 3—38th Street Crosstown Tunnel.

Land:—0

Construction: \$35,000,000

Length: 1.25 miles

Completion of the midtown tunnels under the Hudson and East Rivers will necessitate additional traffic facilities in

the congested midtown district. A tunnel under Manhattan at 38th Street, connecting the two river tunnels, with access near each waterfront, is therefore indispensable.

Project No. 4—Downtown Cross-Manhattan Express Highway

Land: \$4,500,000

Construction: \$15,000,000

Length: 2 miles

To facilitate the heavy volume of crosstown traffic which struggles across the island from Manhattan and Williamsburg Bridges to the Holland Tunnel and West Side Highway, comparative studies were made for elevated highways along Canal and Delancey Streets and for a two-level, six-lane tunnel under Grand Street. The tunnel is recommended as the most desirable solution.

Project No. 8—Concourse-Southerly Extension.

Land: \$2,540,000

Construction: \$4,160,000

Length: 1.3 miles

The southerly extension of the Concourse may be accomplished by a street widening, or by providing a connection with the proposed Exterior Street-Sedgwick Avenue Viaduct, which will require a minimum of land taking. The latter plan will permit of better traffic distribution over Harlem River Bridges to Manhattan, and may be directly connected with the proposed East River-Harlem River Drive.

Project No. 9—Pelham-Portchester Freeway Continuation, via Bronx River Avenue and N. Y. N. H. and H. R. R.

Land: \$3,300,000

Construction: \$5,900,000

Length: 6.3 miles

If Westchester County completes the proposed Pelham-Portchester Freeway, New York City must do its part to tie in with this project which will definitely relieve traffic congestion on Boston Post Road. A new highway from Pelham Bay Park, to and along East Tremont and Bronx River Avenues, leading directly to Eastern Boulevard and Whitlock Avenue, the principal Triboro Bridge Approach would accomplish this most directly.

Project No. 10—Parkway Extensions—The Bronx.

To expedite the movement of through passenger vehicles and remove this fast traffic from ordinary streets, the proposals of the Department of Parks for the continuation of Westchester County Parkways through the Bronx are advocated. The proposals are:

Project No. 10a—Hutchinson River Parkway.

Land: \$1,200,000

Construction: \$3,600,000

Length: 3.6 miles

Extension of Hutchinson River Parkway through Pelham Bay Park to Eastern Boulevard.

Project No. 10b—Bronx River Parkway.

Land: \$3,300,000

Construction: \$6,200,000

Length: 6.4 miles

Reconstruction and extension of Bronx River Parkway through Bronx Park to Eastern Boulevard and Whitlock Avenue, were originally studied and advocated. The costs given are for this route. Subsequently the city has practically decided to route this parkway along Metcalf Avenue to Eastern Boulevard. Although probably some immediate saving will be effected in this way it will ultimately require an additional Bronx Shore Parkway to connect with the Triboro and Whitestone Bridges, at considerable additional cost.

Project No. 10c—Mosholu Parkway.

Land:—0

Construction: \$2,850,000

Length: 3.5 miles

Reconstruction and extension of Mosholu Parkway from Henry Hudson Parkway to the Concourse and Bronx River Parkway Extension.

Project No. 10d—Bronx-Pelham Parkway.

Land:—0

Construction: \$1,900,000

Length: 2 miles

Reconstruction of Bronx-Pelham Parkway from Bronx Parkway Extension to Hutchinson River Parkway Extension by construction of two three-lane roadways in the center of the existing right-of-way, development of bridle path, walks, marginal playgrounds and service roads.

**Project No. 14—Eastern-Interboro Parkway Connection
—Brooklyn.**

Land: \$3,800,000

Construction: \$1,500,000

Length: 1.6 miles

This project provides a direct connection from Interborough to Eastern Parkways and the center of Brooklyn. At present this area is blocked by the Long Island Railroad on Atlantic Avenue at East New York Station, and by numerous elevated and subway lines which converge on a maze of structures in this vicinity. Jamaica and East New York Avenues must be widened for a short distance and the proposed East New York underpass made sufficiently wide for Interboro Parkway traffic.

Eastern Parkway Extension should also be widened from Rockaway to Ralph Avenues, which may well be accompanied by a clearance and rehousing project, in which all buildings between Eastern Parkway and Jamaica Avenue would be demolished and the many small irregular blocks consolidated to create several new super-blocks.

Project No. 32—Cross-Brooklyn Express Highway.

Land: \$6,900,000

Construction: \$8,800,000

Length: 9 miles

The necessity for a continuous commercial route across Brooklyn suggests a depressed express highway paralleling the New York Connecting Railroad from Bay Ridge to East New York, with direct connections to Sunrise Highway and the proposed Brooklyn-Queens Highway, outer route (No. 20).

**Project No. 33—Manhattan Beach Express Highway
—Brooklyn.**

Land: \$600,000

Construction: \$800,000

Length: 3 miles

A highway constructed on the abandoned Manhattan Beach Branch of the Long Island Railroad would take advantage of an existing right-of-way of excellent direction, with grade separations at all street intersections already built, providing a direct and rapid connection between Manhattan Beach and all parts of Brooklyn that would be served by the Cross-Brooklyn Express Highway (No. 32).

Project No. 15—Shore Parkway.

Land: \$5,300,000

Construction: \$14,200,000

Length: 16 miles

The development of a south circumferential boulevard as part of a proposed metropolitan by-pass will be attained when Shore Drive is extended along Gravesend Bay, and is continued along or near Guider and Emmons Avenues, through Marine Park to Flatbush Avenue, and ultimately to Sunrise Highway near Cross Bay Boulevard. This project may be developed in three stages:

- (1) From Dyker Beach Park to Flatbush Avenue Extension.
- (2) From Flatbush Avenue Extension to Sunrise Highway.
- (3) Addition of express parkway parallel to present Shore Road.

Project No. 17—Sunrise Freeway-Southern Parkway.

Land: \$500,000

Construction: \$7,500,000

Length: 7.2 miles

The necessity for enlarging the present Sunrise Highway from its western terminus to Laurelton Parkway is generally recognized. Plans have been prepared by the State Department of Public Works which provide six lanes of traffic without grade crossings, in addition to two marginal streets. This will relieve congestion on the principal approach to Brooklyn from Long Island.

Project No. 20—Brooklyn-Queens Highway Outer Route.

Land: \$5,640,000

Construction: \$8,460,000

Length: 6.2 miles

The outer route aims to provide a continuous highway from South Brooklyn, through East New York to Astoria in Queens, by an express roadway closely paralleling the line of the New York Connecting Railroad. North of Queens Boulevard this route has been mapped by the Queens Topographical Bureau. It is necessary to continue its line south into Brooklyn to complete the project.

Project No. 31—Cypress Hills Express Highway.

Land: \$3,100,000

Construction: \$2,700,000

Length: 2.6 miles

A connecting link along Cypress Hills Street from the westerly end of Sunrise Highway to the proposed Brooklyn-Queens Crosstown Highway, described above, will provide a continuous commercial route from the South Shore of

Long Island to Brooklyn, Queens, Manhattan and the Bronx. By extending this route south to Linden Boulevard, an alternate connection between Projects 20 and 32 may be obtained.

Project No. 21—Horace Harding Boulevard-Borden Avenue Connection—Queens.

Land: \$2,000,000

Construction: \$5,600,000

Length: 5.5 miles

With the construction of the 38th Street tunnel, the westerly continuation of Horace Harding Boulevard along Eliot, Caldwell and Borden Avenues become necessary. Here is an opportunity to develop a real express highway through an area largely undeveloped, on a right of way at least 180 feet wide.

Project No. 25—Creedmoor Freeway.

Land: \$1,300,000

Construction: \$4,000,000

Length: 5.5 miles

Land for this proposal should be acquired along the old Stewart Railroad right-of-way, to provide a direct express thoroughfare from Astoria Boulevard, the principal Triboro Bridge approach, to Jericho Turnpike.

Project No. 26—Queens Boulevard—Rockaway Connection.

Land: \$10,300,000

Construction: \$8,500,000

Length: 12.5 miles

A southerly continuation of Queens Boulevard to the Rockaways has been widely advocated. A readily obtainable solution is the development of Van Wyck Boulevard at least to Sunrise Highway. Another plan proposes a new highway along the Atlantic Division of the Long Island Railroad and partly over the abandoned Cedarhurst cut-off to Beach Channel Drive at Far Rockaway, with a spur to the Atlantic Beach Bridge. This will provide a circumferential highway to the Rockaways without interfering with the future development of Jamaica Bay or the better circulation of its waters.

Project No. 34—Cross Island Parkway.

Land: \$3,500,000

Construction: \$9,000,000

Length: 10 miles

To complete the proposed Metropolitan Loop on Long Island, a parkway from the Bronx-Whitestone Bridge approach, along Little Neck Bay and paralleling the city line to the Sunrise Highway is proposed by the Department of Parks. The completed Laurelton Parkway becomes a part of this loop.

Project No. 30—Hylan Boulevard Improvement —Richmond.

Land: \$1,100,000

Construction: \$5,800,000

Length: 11 miles

With the completion of the Narrows Tunnel, Hylan Boulevard becomes one link in the metropolitan by-pass from New England to the South. It should, therefore, be

planned as a major thoroughfare, with separate lanes for through traffic from the tunnel to the Outerbridge Crossing.

In addition to the above express highways and parkways, for which preliminary studies and estimates have been made, the following through routes are recommended for inclusion in the master plan.

<i>Project No.</i>	<i>Miles</i>
109—HARLEM RIVER DRIVE EXTENSION— Manhattan-Bronx	2.6
116—HUDSON RIVER FREEWAY— Manhattan-Bronx	2.9
143—CROSS (STATEN) ISLAND PARKWAY— Richmond	5
144—RICHMOND PARKWAY—Richmond	7.7

The following existing major highways, because of their exceptional width and strategic location may be converted into non-stop express highways:

<i>Project No.</i>	<i>Miles</i>
130—GRAND CONCOURSE—Bronx	4.5
121—EASTERN PARKWAY—Brooklyn	2.5
117—OCEAN PARKWAY—Brooklyn	5
119—FLATBUSH AVENUE EXTENSION— from the proposed Shore Parkway to the Marine Parkway Bridge—Brooklyn	1
135—QUEENS BOULEVARD— from Van Dam Street to Union Turnpike. Queens	6.2

B—MAJOR STRUCTURES AND THEIR APPROACHES

As an integral part of this system of expressways, several major engineering structures are necessary. They are here presented with separate figures for their principal approaches (see Fig. 2).

Structure "A" and No. 104—38th Street East River Tunnel and Approaches.

This tunnel, which is now under construction, will relieve the greatly overburdened Queensboro Bridge. The approaches still require study in Queens, where direct access must be provided from Brooklyn to the tunnel as well as to Van Alst Avenue. Additional cost of approaches—\$6,000,000.

Structure "B" and No. 106—Bronx-Whitestone Bridge and Approaches.

This has been financed and is now under construction by the Triboro Bridge Authority. It will provide another link between Long Island and the mainland, and will make the 1939 World's Fair readily accessible from the north. The Queens approach will include the two-mile Whitestone Parkway, with a fan-shaped plaza at the bridge-head to connect with the future Cross Island Parkway (No.34) and Cross Island Boulevard (No. 23).

The Bronx Approach will extend along Ferris Avenue to Eastern Boulevard and lead directly to the Hutchinson River Parkway Extension (No. 10A) which may be readily expanded to include an independent freeway (as an alternate to Project No. 9) to connect with Baychester Avenue and the Pelham-Portchester Freeway. Cost of Parallel Freeway—2.3 miles—Land: \$200,000 Construction: \$1,600,000.

Project No. 5—Queensboro Bridge Approaches—Manhattan.
Land: \$7,137,000
Construction: \$1,900,000

Length:—

The greatest traffic concentration at peak hours in the entire city occurs at the Manhattan end of the Queensboro Bridge. Extension of the vehicular approach from 2nd to 3rd Avenues with the construction of a bus terminal and parking garage over part of this block; the development of lateral feeders from 56th to 65th Streets and the arcading of sidewalks on 59th and part of 60th Streets are recommended.

Project No. 105—Triboro Bridge Approaches—Bronx.
Land: \$2,800,000
Construction: \$3,900,000

Length: 2.1 miles

With the completion of Triboro Bridge a new traffic problem has developed in the Bronx, requiring that further attention be given to its approaches. Southern Boulevard from Cypress to Whitlock Avenues must be widened or double-decked. Whitlock Avenue should also be widened to Leggett Avenue. Separate lanes or a depressed express roadway should be provided for bridge traffic, similar to the Astoria Boulevard approach in Queens.

Structure "F"—Reconstruction Brooklyn Bridge.
Cost: \$6,150,000

By removing the obsolete elevated railroad tracks from the old Brooklyn Bridge, four ample lanes may be provided for vehicles, and bus traffic substituted for the trolley lines. This would convert the old bridge into a useful modern traffic structure.

Project No. 102—Improvement of Brooklyn Bridge Approaches.
Land: \$4,800,000
Construction: \$1,000,000

The bridge approaches must be rebuilt, and in Manhattan the pending rehabilitation of City Hall Park and the future reconstruction of Foley Square must provide for better distribution of vehicles at the bridge approach. In Brooklyn a more ample connection should be provided by improving the access to Smith Street.

Structure "E"—Harlem River Crossing
Construction: \$9,500,000

A Harlem River Crossing is needed at Park Avenue, either as a tunnel or a high-level bridge, to provide direct access from the Concourse and Exterior Street to the Harlem River Drive and the avenues in the center of Manhattan.

Structure "D"—Battery-Governor's Island-Brooklyn Tunnel.
Cost: \$70,000,000

Next in importance is the proposed Battery-Governor's Island-Hamilton Avenue Tunnel from Manhattan to Brooklyn. By causing the traffic between Manhattan and South Brooklyn to by-pass downtown Brooklyn completely, this tunnel will change traffic densities in the downtown business section of Brooklyn, and will definitely relieve congestion in Flatbush, 4th and Atlantic Avenues.

Project No. 103—Battery-Governor's Island Tunnel Approaches.

The Brooklyn approaches to this tunnel may be developed according to one of the two following systems:
Land: \$3,200,000

Construction: \$3,100,000

Length: 1 mile

I-a Widening Hamilton Avenue with an express highway to 4th Avenue and a bascule bridge over Gowanus Creek.

Land: \$1,400,000

Construction: \$6,200,000

Length: 2.2 miles

I-b Continuing express highway along 3rd and 2nd Avenues to Shore Parkway.

Land: \$4,100,000

Construction: \$900,000

Length: 1.6 miles

I-c Widening Prospect Avenue from 4th Avenue to Ocean Parkway.

Project No. 103 Alternate

Land: \$4,265,000

Construction: \$2,735,000

Length: 2.1 miles

II-a Connecting the tunnel plaza directly with Grand Army Plaza and Eastern Parkway via Douglas Street and St. Johns Place.

Land: \$2,300,000

Construction: \$500,000

Length: 1.1 miles

II-b 1-b continued north along 3rd Avenue to II—a. (1-b of this portion of project is identical to 1-b in No. 103 above.)

Land: \$500,000

Construction: \$100,000

II-c Connecting this system with No. 19A.

	TOTALS—I	TOTALS—II
Land	\$8,700,000	\$8,465,000
Construction	10,200,000	9,535,000
TOTAL	\$18,900,000	\$18,000,000

Structure "C"—The Narrows Tunnel

Land: \$4,000,000

Structures: \$40,000,000

The Narrows Tunnel will connect Brooklyn with Richmond and will make the latter more accessible from Manhattan when the Battery-Hamilton Avenue Tunnel (Structure "D") is built.

Project No. 107—Narrows Tunnel Approaches.
Land:—0

Construction: \$3,700,000

Length: 1.9 miles

a. Brooklyn—Widening and improving Fort Hamilton Parkway south of the proposed Brooklyn Crosstown Express Highway. (No. 32)

Land: \$800,000

Construction: \$1,200,000

Length: 1.6 miles

b. Richmond—Completing the widening and improvement of Bay Street from Tompkinsville to Hylan Boulevard.

C—MAJOR HIGHWAYS

These proposals refer to existing or proposed highways of city-wide importance, which are probably undesirable to develop as expressways not only because of the excessive cost, but also because of the need for retaining them as local streets, traversing built-up areas. See Figure 2.

Project No. 6—Park Avenue Improvement—Manhattan.
Land: \$11,600,000

Construction: \$3,800,000

Length: 1.6 miles

To facilitate traffic movement along Park Avenue north of 96th Street, it is recommended that Park Avenue be widened between 96th and 116th Streets where the masonry viaduct of the New York Central Railroad acts as a dangerous obstruction.

This improvement should be deferred until the ultimate disposition of the New York Central tracks north of 96th Street has been determined. If the tracks are depressed, the present railroad viaduct might be converted into an express highway.

Project No. 101—Park Avenue—Manhattan.

In the vicinity of Grand Central Terminal the traffic capacity of Park Avenue may be increased by easing up the sharp curves on the viaduct over 42nd Street and in the roadway through the New York Central Building. The tunneling of 40th Street beneath Park Avenue might also be considered as engineering studies made by the Mayor's Committee on City Planning show it to be perfectly feasible, structurally.

Project No. 7—Houston Street Improvement—Manhattan.
Land: \$4,800,000

Construction: \$700,000

Land acquired by the Board of Transportation for the city-owned subway makes it possible to widen Houston Street into an attractive local boulevard, which may be extended in the future from Chrystie-Forsythe Streets to the East River Drive.

Project No. 11—Exterior Street-Sedgwick-Bailey Avenues—Bronx.

Land: \$3,487,000

Construction: \$1,000,000

Length: 4.7 miles

These thoroughfares should be widened and connected by the extension of Cedar Avenue and Harlem River Terrace. A continuous route will then be provided along the east bank of the Harlem River directly to the Bronx Municipal Market and Triboro Bridge.

Project No. 12—Bronx Crosstown Highway—Bronx.
Land: \$7,100,000

Construction: \$5,900,000

Length: 5 miles

The frequently proposed Cross-Borough Highway should be revived in order to provide an adequate approach to the Bronx-Whitestone Bridge from the west, with direct connection to George Washington Bridge.

The most economical route still available utilizes the present Washington Bridge across the Harlem River, and for the immediate future follows Boscobel and Cromwell Avenues to Mt. Eden Avenue. It also includes a direct line over a new right-of-way for this distance, to be mapped immediately and acquired in the future. From Mt. Eden Avenue the route across the Harlem Valley at 174th Street passes along the north boundary of Crotona Park and across the Bronx River Valley on a new viaduct at 176th Street to 177th Street. It then follows 177th Street, which may still be readily widened to Eastern Boulevard, where it connects directly with the Bronx-Whitestone Bridge approach.

Project No. 13—Bushwick Avenue Extension—Brooklyn.
Land: \$5,700,000

Construction: \$700,000

Length: 1.6 miles

The direct extension of Bushwick Avenue to Williamsburg Bridge has recently been revived. This project passes through a blighted area where at present there are no wide streets, and provides a logical continuation of the present widened Bushwick Avenue as a direct route for pleasure traffic between outer Brooklyn and the Williamsburg Bridge.

Project No. 16—Atlantic Avenue Improvement—Brooklyn-Queens

Cost: \$18,404,000 to \$25,000,000

Length: 5.3 miles

The most urgently needed improvement in Brooklyn is elimination of the Long Island Railroad tracks from the surface of Atlantic Avenue. This may be done in several stages:

First: The East New York grade elimination mentioned in Project No. 14. This will not only provide a direct connection for pleasure traffic between Interboro and Eastern Parkways, but will also facilitate commercial traffic on East New York Avenue, which at present is seriously retarded by the railroad grade crossing.

Second: (No. 16A) Elevation or depression of the tracks to 102nd Street, which will provide better access to Sunrise Highway, eliminate the Woodhaven Boulevard grade crossing and the temporary Rockaway Boulevard Bridge.

Third: (No. 16B) Elevation or depression of tracks to Jamaica.

Immediate action should be taken to agree upon some method of grade elimination as described in the 1932 report

prepared jointly by the Railroad, Board of Transportation, Transit Commission and City Officials, in order to abolish this dangerous condition.

*Project No. 18—Metropolitan Avenue Improvement—
Brooklyn-Queens.*

Land: \$3,200,000

Construction: \$2,100,000 Length: 6.2 miles

This thoroughfare, because of its directness and central location should be widened throughout to 100 feet. New setback building lines should, therefore, be established at once to prevent further new construction on the present inadequate right-of-way.

Project No. 19—(A, B, C and D) Brooklyn-Queens Cross-town Highway, Inner Route.

Land: \$22,715,000

Construction: \$13,420,000 Length: 13.3 miles

Of all the highway projects in the entire city, the most difficult and costly to build is a much needed continuous north-south thoroughfare extending from downtown Brooklyn to the Triboro Bridge approaches in Queens. Extensive studies for this thoroughfare have led to the establishment of a principal trunk route from Astoria Boulevard to a point near the intersection of Washington and Park Avenues in Brooklyn, where three feeder thoroughfares will converge—the existing Washington Avenue and branches A and C of Project 19—the former connecting with Fourth Avenue south of Flatbush Avenue, by means of a new diagonal street; the latter connecting with Brooklyn Bridge Plaza, and the Manhattan Bridge approach, by a widened Tillary Street.

In addition to these two branches, two other spurs to the main trunk are proposed: 19B, which splits off at Humboldt Street and Meeker Avenue, connecting downtown Brooklyn directly with the 38th Street-East River Tunnel, passing through Greenpoint and under Newtown Creek; and 19D, branching off at Union Avenue near Broadway and connecting via Montrose Avenue and the line of the Bushwick branch of the L. I. R. R., with Metropolitan, Eliot and Borden Avenues to Queens and Horace Harding Boulevards.

The principal route or trunk beginning at Washington and Park Avenues going north, continues along Rutledge Street, widened, to the intersection of Union and Montrose Avenues, thence along Leonard Street to the intersection of Meeker Avenue and Humboldt Street, continuing along Meeker Avenue over the authorized Newtown Creek high level bridge to Laurel Hill Boulevard and Borden Avenue in Queens. It then follows 43rd Street north to Skillman Avenue, thence swinging east to 50th Street, across Sunnyside railroad yards. It then follows 50th Street, widened, to Astoria Boulevard.

The status of this proposal is critical. In Brooklyn it is well on the way to realization, as Tillary Street and Meeker Avenue are being widened. The bridge over Newtown Creek is also assured. However, in Queens unless immediate action is taken to widen 43rd and 50th Streets, the construction of large apartment houses will make the cost of this widening prohibitive.

It will then be necessary to use Laurel Hill Boulevard, which follows an indirect line, or to reach Astoria Boulevard by swinging east onto 51st Street and Bowery Lane which may still be widened.

Project No. 22—Woodhaven-Cross Bay Boulevard Improvement—Queens.

Land: \$1,600,000

Construction: \$800,000 Length: 2.0 miles

The widening of Woodhaven Boulevard through Forest Park and south to Liberty Avenue is urgently needed.

The Department of Parks has undertaken the improvement of Cross Bay Boulevard by reconstructing Broad Channel Bridge, developing an elaborate grade separation at Beach Channel Drive and extending Cross Bay Boulevard to the ocean, with funds obtained on a self-liquidating basis, the income to be derived from bridge tolls.

Project No. 23—Cross Island Boulevard Completion—Queens.

Land: \$3,900,000

Construction: \$6,700,000 Length: 10 miles

In the eastern part of Queens, Cross Island Boulevard will become the principal north-south commercial artery and one of the main approaches to the Bronx-Whitestone Bridge. New building lines should therefore be established to provide a minimum width of 160 feet, with a widening to 100 feet of its logical continuation along Springfield Boulevard.

Project No. 24—Union Turnpike Completion—Queens.

Land: \$500,000

Construction: \$700,000 Length: 6.5 miles

The completion of Union Turnpike from Kew Gardens east to Winchester Boulevard and west to Myrtle Avenue, and the necessary widening of Myrtle Avenue and Cooper Avenue west to Project No. 20 will relieve traffic congestion on Interboro and Grand Central Parkways.

Project No. 27—Beach Channel Drive—Queens.

Land: \$3,000,000

Construction: \$2,000,000 Length: 5.5 miles

The improvement of this thoroughfare involves a grade separation at Hammels Junction Station of the Long Island Railroad. It will connect with the proposed Rockaway Express Highway (No. 26) and by a new street through the old Wave Crest section of Far Rockaway will provide direct access to the Atlantic Beach Bridge, thus giving the Rockaway peninsula one continuous modern highway.

Project No. 29—Clove Road-Forest Avenue Improvement—Richmond.

Land: \$1,000,000

Construction: \$2,500,000 Length: 4.3 miles

The Borough of Richmond has no acute traffic problems, but with the possibility of a tunnel under the Narrows, an arterial system connecting this tunnel with the three bridges should be anticipated. The Outerbridge Crossing Link has already been described (No. 30). The Clove Road-Forest Avenue Improvement will connect the tunnel directly with the Bayonne and Goethals Bridges.

Project No. 28—Richmond Avenue-Ramona Blvd. Improvement—Richmond.

Land: \$1,000,000

Construction: \$4,998,000

Length: 8.8 miles

Richmond Avenue-Ramona Boulevard Improvement, Richmond, will provide a direct north-south thoroughfare in the west-central part of the island.

This completes the major arterial highway system recommended for development during the coming three six-year periods. The following supplementary highway proposals are closely related to the proposed eighteen-year program. They represent urgent needs and require early study.

MANHATTAN

Project No.

- 110—WEST SIDE PIER APPROACHES
49-50th Street
- 111—TRANSVERSE ROADS, CENTRAL PARK
- 112—FIFTH AVENUE, SOUTHERLY EXTENSION—WEST BROADWAY IMPROVEMENT
- 113—110th STREET CROSSTOWN IMPROVEMENT AND TRIBORO BRIDGE CONNECTION

BRONX

Project No.

- 114—SOUTHERN BOULEVARD—CROTONA PARKWAY IMPROVEMENT
- 115—WEBSTER AVENUE EXTENSION
- 131—BRONX RIVER PARKWAY—GRAND CONCOURSE CONNECTION
- 132—BAYCHESTER AVENUE COMPLETION
- 132A—EASTCHESTER ROAD COMPLETION

BROOKLYN

Project No.

- 118—FULTON STREET IMPROVEMENT
- 119—FLATBUSII AVENUE IMPROVEMENT
- 120—WASHINGTON AVENUE EXTENSION
- 128—PENNSYLVANIA AVENUE COMPLETION

QUEENS

Project No.

- 122—LINDEN BOULEVARD COMPLETION
- 123—JUNCTION BOULEVARD—
94th STREET COMPLETION
- 124—OCEAN BOULEVARD—ROCKAWAY
- 127—MOTOR PARKWAY RECONSTRUCTION
—From Grand Central Parkway to
Horace Harding Boulevard
- 133—LAUREL HILL BOULEVARD COMPLETION
- 134—MAIN STREET—VAN WYCK BOULEVARD
- 136—ROCKAWAY BOULEVARD WIDENING

RICHMOND

Project No.

- 139—VICTORY BOULEVARD
From Bay St. to Clove Road
- 140—SEASIDE BOULEVARD DEVELOPMENT
- 141—RICHMOND TERRACE IMPROVEMENT
- 142—WEST SHORE BOULEVARD

D—SECONDARY HIGHWAYS

To complete the city's highway system on the master plan, other street improvements of lesser importance are necessary. They have been classified as secondary highways, of which the following are recommended for early study:

Manhattan

Project No.

- 201—Avenue A-Rutgers St. Widening
- 202—Avenue B-Clinton St. Widening
- 204—East Broadway Widening
- 205—Delancey-Kenmare St. Extension
- 208—Pearl Street Widening
- 209—Pike Street Widening
- 211—Center Street Widening
- 213—Beach-Walker Street
- 214—Green St.-Canal St. to West Houston St.

Bronx

Project No.

- 226—Burke Ave.-205th St. Improvement
- 227—Bronx River Ave. Completion
(Tremont Ave. Improvement)
- 228—Crotona Ave.-Prospect Ave. Connection
- 230—Fieldston Road Completion
- 231—Lafayette Ave. Extension
- 233—East 170th St.-St. Pauls Ave.-Crotona
Park South-East 172nd St. Connection
- 234—Palisade Ave. Completion
- 235—University Ave. Widening
- 236—White Plains Road Completion
- 237—Van Cortlandt Ave.-East 211th St. Connection
- 238—West 254th St. Widening

Brooklyn

Project No.

- 251—Avenue U Extension
- 252—Gravesend Neck Road Widening
- 253—Bedford Ave. Widening
- 254—Coney Island Improvement
- 255—Cortelyou Road Connection
- 256—Flatlands Ave.-Fairfield Ave. H Completion
- 257—Force Tube Ave. Completion
- 258—Gravesend Ave. Improvement
- 259—Gerritsen Ave. Completion
- 260—Jay and Smith St. Widening
- 261—Kent Ave. and Washington Ave. Widening
- 262—Maspeth Ave. Completion
- 263—Neptune Ave. Extension
- 264—Ocean Ave. Extension over Sheepshead Bay
- 265—Seaview Ave.-Ave. U to Marine Parkway
- 266—Stillwell Ave. Completion
- 267—Vandervoort Avenue
- 269—9th St. Widening-Hamilton Ave. to Smith Street
- 270—36th-37th St. Widening

Queens

Project No.

- 276—Baisley Boulevard Widening
- 277—Beach 9th Street
- 278—Bell Blvd.-Springfield and Braddock Aves.
Completion and Widening
- 279—Berrian Boulevard Completion
- 280—Betts Avenue Widening
- 281—Broadway Widening
- 282—Cooper Avenue Widening

MAYOR'S COMMITTEE ON CITY PLANNING

NEW YORK CITY

FIORIELLO H. LA GUARDIA
MAYOR



WILLIAM F. BRUNNER
CHAIRMAN

IN COOPERATION WITH
WORKS PROGRESS ADMINISTRATION

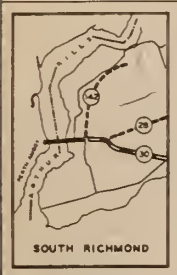
PROPOSALS FOR ARTERIAL, MAJOR & SECONDARY HIGHWAY SYSTEM

-KEY-

EXISTING	EXPRESS HIGHWAYS PARAWAYS & STRUCTURES FOR GENERAL TRAFFIC	PROPOSED
	MAJOR HIGHWAYS CONVERTIBLE INTO EXPRESS HIGHWAYS & PARAWAYS	
	MAJOR HIGHWAYS	
	SECONDARY HIGHWAYS	

SCALE IN FEET

DECEMBER 1937



SOUTH RICHMOND



NOTE: FOR SOUTH RICHMOND
SEE INSERT ABOVE

FIGURE 2.

A T L A N T I C

283—*Dickens Ave. and Regina Blvd. Widening*
 284—*Ditmars Boulevard Completion*
 285—*Douglaston Parkway Completion*
 286—*Dry Harbor Road*
 287—*Fresh Pond Road, 61st St., 58th St.*
 288—*Fairfield Ave.-Flatlands Ave.*
 289—*Farmers Boulevard Widening*
 290—*Flushing Ave.-Grand Ave. Widening*
 291—*14th Avenue Widening*
 292—*Greenpoint-Roosevelt Ave. Widening*
 302—*Mott Avenue Widening*
 303—*111th St. and 110th St. Widening*
 304—*69th Road-73rd Ave. Completion*
 305—*Skillman Avenue Improvement*
 306—*Seagirt Ave. Widening*
 307—*Sutphin Boulevard Widening*
 308—*26th Avenue Completion*
 309—*Utopia Parkway-Fresh Meadow Lane*
 310—*Willels Point Boulevard Completion*
 311—*Hook Creek Boulevard Completion*

Richmond

Project No.

326—*Bloomingdale Road Widening*
 327—*Hugenot Avenue Widening*
 328—*Forest Hill Road*
 329—*Manor Road*
 330—*Tompkins Ave.-Broad St. Stapleton
 to Ft. Wadsworth*

E—SPECIAL INTERSECTIONS

There are numerous traffic knots throughout the city, caused by the confluence of heavily travelled streets, particularly where more than two thoroughfares intersect at one point, or where such intersections are at oblique angles.

The following intersections should be studied in cooperation with the Police Department, for the purpose of improving traffic control, providing pedestrian aisles of safety, and in some places building partial grade separations.

Manhattan

Battery Place-Broadway-West & South Streets
 City Hall Park
 Foley Square
 West Broadway-Canal St.-Church St.
 Washington Square
 Astor Place-4th Ave.-Kenmore St. Widening-
 Bowery to Lafayette Street
 (Also Extension)
 6th Ave.-Christopher St.-Greenwich Ave.
 Sheridan Square
 8th Ave.-Greenwich Avenue
 Union Square
 Madison Square
 Greeley Square-Herald Square
 Times Square
 Columbus Circle
 Lincoln Square

110th St.-Fifth Avenue
 110th St.-Central Park West
 Broadway-108th St.-West End Avenue
 Roosevelt Square
 Meyer Square
 Broadway-St. Nicholas Ave.-168th St.
 Broadway-Dyckman St.
 Broadway-10th Ave.-West 218th St.

Bronx

Bainbridge Ave.-Jerome Ave.
 Boscobel Ave.-167th St.
 Boston Road-167th Street
 Boston Road-West Farms Road-East 177th St.-
 Tremont Avenue
 Bronx Park East-White Plains Rd.-Bronxdale Ave.
 Eastchester Road-Gun Hill Road
 Fordham Road-University Avenue
 Kingsbridge Road-Fordham Road
 McKinley Square
 Prospect Avenue-Southern Boulevard
 Third Avenue-149th Street
 Third Avenue-161-163rd Streets
 Tremont Avenue-Webster Avenue
 Webster Avenue-Fordham Road
 Westchester Square
 Westchester Avenue-163rd Street
 Boston Road Improvement
 Boston Road-West Farms Road-E. 177th Street-
 Tremont Avenue Intersection

Brooklyn

Grand Army Plaza
 Grand Avenue-67th Street Intersection
 Jay Street-Tillary Street
 Linden Boulevard-Kings Highway Intersection
 Fourth-Flatbush-Atlantic Avenues
 Ocean-Bay Parkways Intersection

Queens

Flushing Avenue-Grand Avenue-64th Street
 Merrick Boulevard-Liberty Avenue
 Queensboro Bridge Plaza

LOCAL STREETS

Approximately one-fifth of the city's total area is still inaccessible by public streets. See Figure 1. These areas should be studied so that when it becomes necessary to develop them, streets may be provided which will deviate from the costly inflexible gridiron system wherever irregular boundaries, rolling topography, or use determined by zoning makes larger blocks of irregular shape and size desirable.

SUMMARY OF COSTS

The total estimated cost of the recommended eighteen-year major highway program for land acquisition and new construction of express highways, parkways, structures and their approaches, and major highways (A, B & C), is approximately \$590,000,000.

The costs of land acquisition are based upon 1.3 times the 1937 assessed values; they do not include consequential damages, riparian rights and returns from the resale of land.

Three possible sources of funds are suggested:

1. Federal loans for construction of self-liquidating projects, i. e., the major structures and immediate approaches.

2. Federal and State appropriations for construction of highways which are of regional importance, i. e., the super-highways.
3. City funds for land acquisition in all projects, and for construction of major highways, together with marginal streets and local improvements incidental to super-highways and major structures.

The proposals in the eighteen-year program have accordingly been grouped into three six-year periods, according to their relative urgency, and are listed with suggested sources of funds in the following tables.

The location of projects is shown in these tables by Borough as follows: M—Manhattan; B—Bronx; K—Brooklyn; Q—Queens; and R—State Island.

TABLE 1
Summary Of Costs For The Eighteen-Year Highway Program

6-YEAR PERIOD	TYPE	Total Cost	Construction Cost	Land Acquisition	SOURCES OF FUNDS		
					State-Federal	Self-Liquidating	City
1939 to 1944	Express Highways	148,050,000	112,850,000	35,200,000	83,600,000	....	64,450,000
	Major Structures & Approaches	32,400,000	18,300,000	14,100,000	13,400,000	....	19,000,000
	Major Highways	<u>47,300,000</u>	<u>23,850,000</u>	<u>23,450,000</u>	<u>8,800,000</u>	<u>3,300,000</u>	<u>35,200,000</u>
	Total	227,750,000	155,000,000	72,750,000	105,800,000	3,300,000	118,650,000
1945 to 1950	Express Highways	61,840,000	36,860,000	24,980,000	23,960,000	....	37,880,000
	Major Structures & Approaches	98,250,000	87,250,000	11,000,000	30,000,000	39,000,000	29,250,000
	Major Highways	<u>54,500,000</u>	<u>17,000,000</u>	<u>23,500,000</u>	<u>17,400,000</u>	<u>6,000,000</u>	<u>31,100,000</u>
	Total	214,590,000	141,110,000	59,480,000	71,360,000	45,000,000	98,230,000
1951 to 1956	Express Highways	51,560,000	38,260,000	13,300,000	28,830,000	....	22,730,000
	Major Structures & Approaches	58,400,000	53,750,000	4,650,000	12,500,000	29,200,000	16,700,000
	Major Highways	<u>37,700,000</u>	<u>13,700,000</u>	<u>13,000,000</u>	<u>8,000,000</u>	<u>4,500,000</u>	<u>25,200,000</u>
	Total	147,660,000	105,710,000	30,950,000	49,330,000	33,700,000	64,630,000
GRAND TOTAL		590,000,000	401,820,000*	163,180,000*	226,490,000	82,000,000	281,510,000

*Totals do not include sum of \$25,000,000 allocated to the "Atlantic Avenue Improvement" (Proj. 16), but not divided as to "Construction Cost" or "Land Acquisition."

TABLE 2
Express Highways
First 6-Year Period, 1939-1944

PROJECT	No.	Boro.	Total Cost	Construction Cost	Land Cost	SOURCES OF FUNDS		
						State-Federal	Self Liquidating	City
East River Drive	1	M	34,700,000	24,900,000	9,800,000	20,000,000	....	14,700,000
38th Street Crosstown Tunnel	3	M	35,000,000	35,000,000	....	21,000,000	....	14,000,000
Harlem River Drive	2	M	14,600,000	10,000,000	4,600,000	7,000,000	....	7,600,000
Eastern Interboro Parkway Connection	14	K	5,300,000	1,500,000	3,800,000	1,300,000	....	4,000,000
Parkway Extensions:								
Hutchinson River to Eastern Boulevard	10A	B	4,800,000	3,600,000	1,200,000	3,000,000	....	1,800,000
Bronx River to Tri-Boro Bridge Approach	10B	B	9,500,000	6,200,000	3,300,000	6,000,000	....	3,500,000
Mosholu from Henry Hudson to Bronx River	10C	B	2,850,000	2,850,000	....	2,000,000	....	850,000
Shore Parkway - Dyker Beach Park to Flatbush Ave. Ext.	15A	K	10,000,000	4,700,000	5,300,000	6,000,000	....	4,000,000
Sunrise Freeway-Southern Parkway	17	K-Q	8,000,000	7,500,000	500,000	5,500,000	....	2,500,000
Downtown Cross Manhattan Express Highway	4	M	19,500,000	15,000,000	4,500,000	10,600,000	....	8,900,000
Horace Harding Blvd.-Borden Avenue Conn.*	21	Q	2,000,000	....	2,000,000	....	....	2,000,000
Hutchinson River Freeway (Alternate)	106	B	1,800,000	1,600,000	200,000	1,200,000	....	600,000
TOTAL			148,050,000	112,850,000	35,200,000	83,600,000	....	64,450,000

*Land Acquisition Only

TABLE 3 Major Structures and Approaches First 6-Year Period, 1939-1944								
PROJECT	No.	Boro.	Total Cost	Construction Cost	Land Cost	SOURCES OF FUNDS		
						State-Federal	Self-Liquidating	City
38th Street-East River Tunnel Approach	104	M-Q	6,000,000	6,000,000	....	3,500,000	....	2,500,000
Queensboro Bridge Approaches	5	M	9,000,000	1,900,000	7,100,000	1,900,000	....	7,100,000
Triboro Bridge Approach	105	B	6,700,000	3,900,000	2,800,000	3,000,000	....	3,700,000
Narrows Tunnel Approach (Bay Street Improvement)	107B	R	2,000,000	1,200,000	800,000	....	....	2,000,000
Brooklyn-Queens Crosstown Highway (Inner Route) (38th St. Tunnel Approach)	19B	K-Q	6,100,000	5,300,000	800,000	5,000,000	....	1,100,000
Brooklyn Bridge Approaches (City Hall Park)	102	M-K	2,600,000	....	2,600,000	....	....	2,600,000
TOTAL			32,400,000	18,300,000	14,100,000	13,400,000	....	19,000,000

TABLE 4 Major Highways First 6-Year Period, 1939-1944								
PROJECT	No.	Boro.	Total Cost	Construction Cost	Land Cost	SOURCES OF FUNDS		
						State-Federal	Self-Liquidating	City
Brooklyn Queens Crosstown Highway (Inner Route) Principal Route	19A	K-Q	30,600,000	19,300,000	11,300,000	8,800,000	....	21,800,000
Woodhaven Blvd. Completion	22	Q	5,600,000	3,250,000	2,350,000	....	....	2,300,000
Union Turnpike Completion	24	Q	1,200,000	700,000	500,000	....	3,300,000	1,200,000
* Houston St. Improvement	7	M	4,800,000	....	4,800,000	....	....	4,800,000
* Cross Island Blvd. Completion	23	Q	3,900,000	....	3,900,000	....	....	3,900,000
Brooklyn Queens Crosstown Highway (Inner Route) Tillary Street Extension	19C	K-Q	1,200,000	600,000	600,000	....	....	1,200,000
TOTAL			47,300,000	23,850,000	23,450,000	8,800,000	3,300,000	35,200,000
*Land Acquisition only								

TABLE 5
Express Highways
Second 6-Year Period, 1945-1950

PROJECT	No.	Boro.	Total Cost	Construction Cost	Land Cost	SOURCES OF FUNDS		
						State-Federal	Self-Liquidating	City
Concourse-Southerly Extension	8	B	6,700,000	4,160,000	2,540,000	....	....	6,700,000
**Horace Harding Boulevard Borden Avenue Connection	21	Q	5,600,000	5,600,000	....	3,360,000	.....	2,240,000
Pelham - Portchester - Free-way Continuation	9	B	9,200,000	5,900,000	3,300,000	4,400,000	....	4,800,000
Cypress Hills Express Highway	31	K-Q	5,800,000	2,700,000	3,100,000	2,000,000	....	3,800,000
* Cross Brooklyn Express Highway	32	K	6,900,000	....	6,900,000	....	....	6,900,000
Shore Parkway-Flatbush to North Conduit Avenue	15B	K	9,500,000	9,500,000	....	6,200,000	....	3,300,000
Cross Island (Crocheron) Parkway	34	Q	12,500,000	9,000,000	3,500,000	8,000,000	....	4,500,000
*Brooklyn-Queens Crosstown (Outer-Route)	20	K	5,640,000	....	5,640,000	....	....	5,640,000
TOTAL			61,840,000	36,860,000	24,980,000	23,960,000	....	37,880,000
* Land Acquisition only								
** Construction only								

TABLE 6
Major Structures and Approaches
Second 6-Year Period, 1945-1950

PROJECT	No.	Boro.	Total Cost	Construction Cost	Land Cost	SOURCES OF FUNDS		
						State-Federal	Self-Liquidating	City
Battery-Governors Island Tunnel Approach	103 A,B,C	K	18,900,000	10,100,000	8,800,000	9,000,000	....	9,900,000
Battery-Governors Island Tunnel	D	M-K	70,000,000	70,000,000	....	21,000,000	39,000,000	10,000,000
Brooklyn Bridge Recon-struction	F	M-K	6,150,000	6,150,000	....	....	....	6,150,000
Brooklyn Bridge Approach	102	M-K	3,200,000	1,000,000	2,200,000	....	....	3,200,000
TOTAL			98,250,000	87,250,000	11,000,000	30,000,000	39,000,000	29,250,000

TABLE 7
Major Highways
Second 6-Year Period, 1945-1950

PROJECT	No.	Boro.	Total Cost	Construction Cost	Land Cost	SOURCES OF FUNDS		
						State-Federal	Self-Liquidating	City
**Cross Island Boulevard Completion	23	Q	6,700,000	6,700,000	....	5,400,000	....	1,300,000
Bushwick Avenue Extension	13	K	6,400,000	700,000	5,700,000	....	....	6,400,000
Atlantic Avenue Improvement (East New York Sect.)	16A	K-Q	14,000,000	....	....	6,000,000	6,000,000 (R.R.)	2,000,000
Bronx Crosstown Highway	12	B	13,000,000	5,900,000	7,100,000	4,000,000	....	9,000,000
Metropolitan Avenue Improvement	18	K	3,200,000	....	3,200,000	....	....	3,200,000
*Richmond Avenue-Ramona Boulevard Improvement	28	R	1,000,000	....	1,000,000	....	....	1,000,000
*Clove Road-Forest Avenue Improvement	29	R	1,000,000	....	1,000,000	....	....	1,000,000
Beach Channel Drive Completion	27	Q	5,000,000	3,000,000	2,000,000	2,000,000	....	3,000,000
*Exterior St.-Sedgwick-Baily Avenue Improvement	11	B	3,500,000	....	3,500,000	....	....	3,500,000
Houston Street Improvement	7	M	700,000	700,000	....	....	....	700,000
TOTAL			54,500,000	17,000,000	23,500,000	17,400,000	6,000,000	31,100,000
* Land Acquisition only ** Construction only								

TABLE 8
Express Highways
Third 6-Year Period, 1951-1956

PROJECT	No.	Boro.	Total Cost	Construction Cost	Land Cost	SOURCES OF FUNDS		
						State-Federal	Self-Liquidating	City
**Brooklyn-Queens Crosstown Highway (outer route)	20	K-Q	8,460,000	8,460,000	....	6,260,000	....	2,200,000
**Cross Brooklyn Arterial Highway	32	K	8,800,000	8,800,000	....	6,000,000	....	2,800,000
Rockaway Express Highway	26	Q	18,800,000	8,500,000	10,300,000	7,200,000	....	11,600,000
Hylan Boulevard Improvement	30	R	6,900,000	5,800,000	1,100,000	4,000,000	....	2,900,000
Bronx-Pelham Parkway Reconstruction	10D	B	1,900,000	1,900,000	....	1,200,000	....	700,000
Creedmoor Parkway or Freeway	25	Q	5,300,000	4,000,000	1,300,000	3,370,000	....	1,930,000
Manhattan Beach Express Highway	33	K	1,400,000	800,000	600,000	800,000	....	600,000
TOTAL			51,560,000	38,260,000	13,300,000	28,830,000	....	22,730,000
* Land Acquisition only ** Construction only								

TABLE 9
Major Structures and Approaches
Third 6-Year Period, 1951-1956

PROJECT	No.	Boro.	Total Cost	Construction Cost	Land Cost	SOURCES OF FUNDS		
						State-Federal	Self-Liquidating	City
Narrows Tunnel	C	K-R	44,000,000	40,000,000	4,000,000	10,800,000	29,200,000	4,000,000
Approach	107A	K-R	3,700,000	3,700,000	....	1,700,000	....	2,000,000
Approach	107B	K-R	1,200,000	550,000	650,000	....	....	1,200,000
Harlem River Crossing	E	M-B	9,500,000	9,500,000	....	....	....	9,500,000
TOTAL			58,400,000	53,750,000	4,650,000	12,500,000	29,200,000	16,700,000

TABLE 10
Major Highways
Third 6-Year Period, 1951-1956

PROJECT	No.	Boro.	Total Cost	Construction Cost	Land Cost	SOURCES OF FUNDS		
						State-Federal	Self-Liquidating	City
**Metropolitan Avenue Improvement	18	K	2,100,000	2,100,000	....	....	....	2,100,000
Atlantic Avenue Improvement (Rockaway Blvd.-Jamaica)	16B	Q	11,000,000	....	....	4,500,000	4,500,000 (R.R.)	2,000,000
**Exterior Street-Sedgwick-Bailey Avenue Improvement	11	B	1,000,000	1,000,000	....	....	....	1,000,000
Park Avenue Improvement	6	M	15,400,000	3,800,000	11,600,000	....	....	15,400,000
**Clove Road-Forest Avenue Improvement	29	R	2,500,000	2,500,000	....	1,500,000	....	1,000,000
**Richmond Avenue-Ramona Boulevard Improvement	28	R	3,000,000	3,000,000	....	2,000,000	....	1,000,000
Brooklyn-Queens Crosstown Highway (inner route) Montrose-Eliot Avenue Connection	19D	Q	2,700,000	1,300,000	1,400,000	....	....	2,700,000
TOTAL			37,700,000	13,700,000	13,000,000	8,000,000	4,500,000	25,200,000

* Land Acquisition only
** Construction only

Water Supply

INTRODUCTION

The staff did not attempt a detailed engineering study of water supply, but rather sought to measure the city's future needs on the basis of the probable ultimate population. In this study, the adequacy of the supply obtainable under the several courses of action open to the city in meeting the future demands for water were considered, as well as the affects of such action upon the capital outlay and expense budgets.

With the exception of population estimates, all data employed in this study were obtained from either the Board of Water Supply or the Department of Water Supply, Gas and Electricity. The former agency is charged with the planning and construction of additions to the city's water supply system, while the latter handles the operation and maintenance of the completed system.

SOURCES OF SUPPLY

Prior to the formation of the greater city, Manhattan and a portion of The Bronx obtained water from the Croton Watershed; the Williamsbridge water supply came from the Bronx and Byram Rivers; Brooklyn was supplied by the Ridgewood system, while wells and streams served the developed portions of Queens and Richmond. Pollution, and salt water infiltration resulting from overdraft on local sources, lowered the quality of much of the ground water used. After 1898 when the five boroughs were consolidated, New York City experienced a rapid population growth and faced the need for additional water. By 1917 the first installment of Catskill water was delivered to the greater city, and in 1927 the second stage of the Catskill supply was in operation.

Present Dependable Yield

Figure I, prepared by the Board of Water Supply, shows the present water supply system of the city. The estimated dependable yield of this system is 1,039 million gallons daily, of which 959 million gallons are available from municipal sources. The Catskill system can supply 500, Bronx and Byram 10, and the Croton watershed 300; a total of 810 million gallons daily. The dependable yield of wells in Brooklyn is 115, in Queens 24 and in Richmond 10; a total of 149 million gallons daily.

Privately owned water companies, serving part of Flatbush, Jamaica, Woodhaven and Broad Channel Island have a combined yield estimated at 80 million gallons daily.

Source of Future Supply

Studies completed in 1927 by the Board of Water Supply, indicated that the most available and economic supply to serve the city's anticipated needs could be obtained from the tributaries of the Delaware River lying within New York State. Accordingly, a plan was proposed to deliver additional water to the city through the construction of reservoirs and connecting tunnels in three stages:

1. Water from the Rondout, together with flood water from the Neversink, to bring in 170 million gallons daily.
2. The flood waters of the East Branch to be added, thereby increasing the available supply by 370 million gallons daily.
3. The Little Delaware, Willowemoc and Beaver Kill to be developed, adding some 160 million gallons daily.

This plan was approved by the Board of Estimate and Apportionment, by the State Water Power and Control Commission, and necessary legislation was enacted by the Legislature in 1928. However, the states of New Jersey and Pennsylvania objected to the proposed diversion of water from the Delaware River, and it was not until 1931 that the Supreme Court approved, under certain conditions, the diversion by New York City of 440 million gallons of water daily. Under this decision the city may petition at a future date for approval of an additional diversion, but has a potential supply of 540 million gallons daily, including 100 million gallons from Rondout Creek which was not affected by litigation. See Figure 3.

The first two stages of development were estimated to cost about \$273,000,000⁽²⁾ and to require some 12 years to complete. Due to lack of funds, work on the project was not started until 1936, but under present schedules the first stage is expected to be completed during the year 1945 at a cost of \$210,174,000⁽²⁾. The second stage

⁽²⁾ This report was prepared in March 1938; subsequent developments have increased the original estimates made in 1927. See the Proposed Capital Budget for 1940.

of development, not yet authorized by the city, is estimated to cost \$62,413,000.⁽²⁾ The relatively smaller cost of the second stage covers the construction of the East Branch reservoir and a tunnel from East Branch to Rondout, while the first stage involves more extensive operations, as shown by Figure 3.

In considering future sources of supply, the staff did not include additional wells, due to the reports upon State surveys which indicate that the present level of ground water, particularly in Long Island, is already so low that there is imminent danger of salt water seeping into existing wells. The private companies draw their water from underground sources, which if subject to continued overdraft may have to be supplemented with water from municipal sources to avoid failure of the entire underground supply. Therefore, water available from private sources was also excluded in considering future supply.

DEMAND FOR WATER

Figure 4, reprinted through the courtesy of the Board of Water Supply, shows the average consumption of water in New York City for the years 1868 to 1935 inclusive, and the relation of consumption to the dependable yield of all present sources of supply.

According to the Board of Water Supply the Catskill system was expected to meet the city's water needs for at least 25 years.⁽³⁾ As may be seen by reference to Figure 4, after Catskill water became available in 1917, the total consumption increased each year at the rate of about 30 million gallons daily until the end of 1930, when 1,007 million gallons, or only 32 million gallons less than the total dependable supply, were consumed daily. Since 1930, the use of water has fallen off about 5 per cent due to decreased business, manufacturing and commercial activity. "With the normal return of business activity, there will be a rapid increase in consumption and the demand for water will exceed the present dependable supply."⁽³⁾

Inasmuch as the consumption of water is related to the population served, the average daily consumption expressed in terms of gallons per capita has been the basis of measurement in these studies. Figure 5 shows the past average daily consumption of water per capita: curve "C" from all sources;

and "D" from municipal sources only. Since the water required by law to be supplied to communities outside of New York City amounted to only slightly more than 2 per cent of the total consumed from municipal sources during the period 1917 to 1934 inclusive, the staff did not attempt to determine the population of these communities. It was felt that total per capita consumption from municipal sources, expressed in terms of New York City population, would present an accurate picture of past demand and a reasonable basis for estimating future requirements.

Normal Requirements

The probable future demand for water was estimated on the basis of the annual rate of increase in average daily per capita consumption under various conditions of control as determined by the Department of Water Supply, Gas and Electricity.⁽⁴⁾ However, the staff assumed that the normal per capita demand during the year 1940 would equal the per capita consumption for 1930, and employed its population forecasts to determine the resulting total average daily consumption for each year thereafter.

Without systematic waste control—Within certain limitations the future demand for water will depend upon the effectiveness of waste control work. With a normal amount of inspection work, the Department of Water Supply, Gas and Electricity has been able to reduce leakage from plumbing fixtures, and thus has cut the rate of increase in water consumption. On the basis of continuing such work from time to time, along with suppression of visible leakage in the distribution system, future demand is expected to increase at the annual rate of 1.3 gallons per capita per day. See Figure 5.

With underground leakage suppressed—Studies made by the Department of Water Supply indicate that about 100 million gallons daily, equivalent to the dependable yield of the Rondout project, are lost through underground leakage. From past experience, the Department estimates that systematic inspection of the entire city to detect and stop invisible leakage from water mains and service pipes would reduce consumption by at least 60 million gallons daily. If such work is repeated every two years it is estimated that the annual rate of increase would be reduced to 1.2 gallons per capita per day. See Figure 5. Some 40 million gallons daily, wasted through undetectable leakage, cannot

(3) "A General Description of the Catskill Water Supply and of the Project for an Additional Supply from the Delaware River Watershed and Rondout Creek"—Board of Water Supply of the City of New York—1936.

(4) "Report on Future Water Supply" by Joseph Goodman, Acting Chief Engineer of Water Supply, Department of Water Supply, Gas and Electricity; New York City—1935.

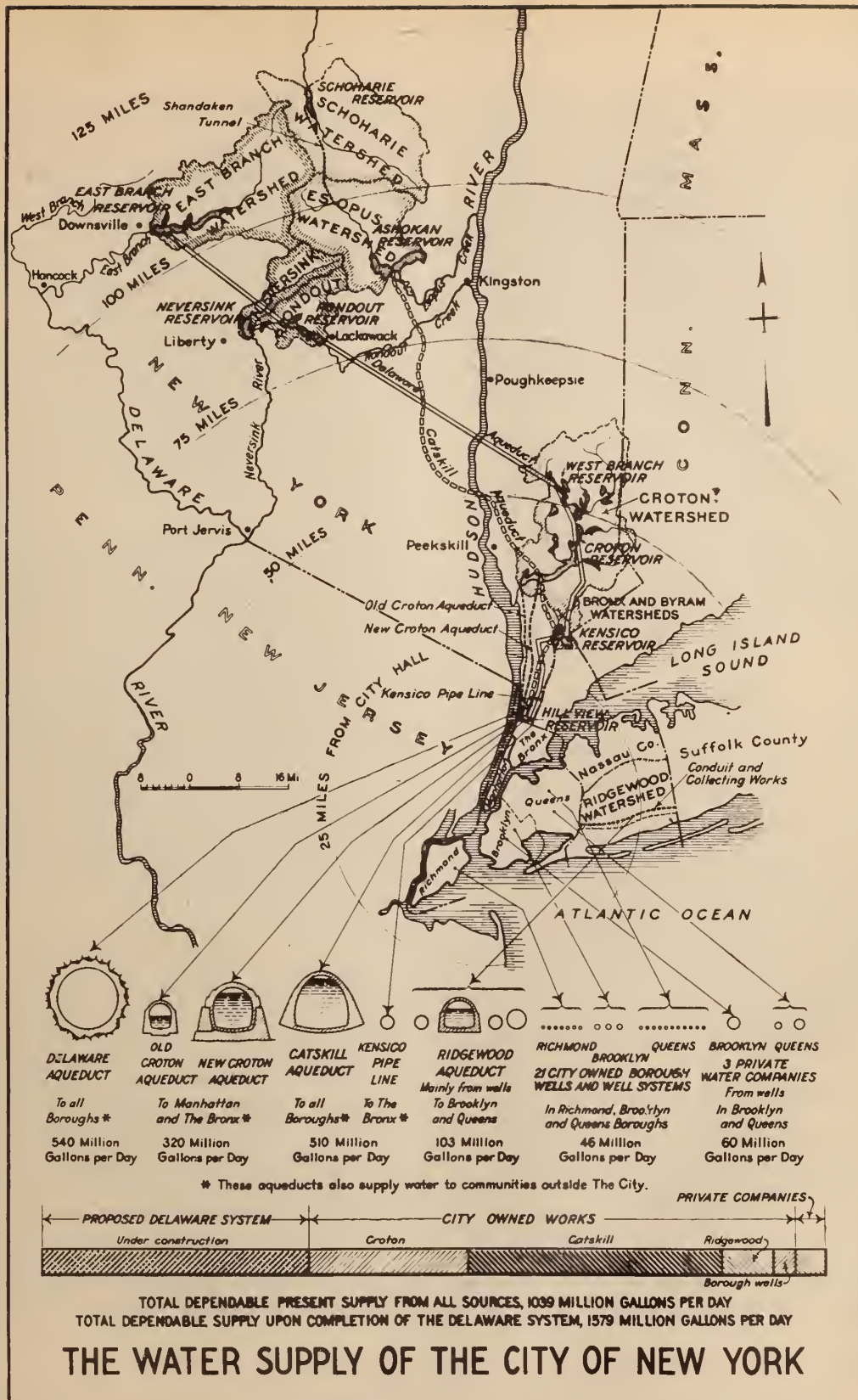


FIG. 3 • PREPARED BY BD. OF WATER SUPPLY

be economically prevented even with systematic inspection work.

With underground leakage suppressed and universal metering—While there has been a rapid growth in the use of water meters in the United States during the past 15 years, New York is one of the few large cities that has not adopted universal metering. The increase in metering is due to the fact that selling water according to meter measurement has been found to be the only method that does not produce inequitable and unjust charges to the consumer; and that universal metering has eliminated more waste and needless use of water than any other method of waste prevention yet devised. Under present laws, practically all water used for commercial and industrial purposes in New York City is metered, but only a small fraction of the water used in residential premises is metered.

Based upon recent studies, the Department of Water Supply estimates that universal metering would, by checking the waste of water from leaky plumbing fixtures and defective hydraulic mechanisms, by reducing the use of water to prevent freezing of pipes and for other unnecessary purposes, reduce normal consumption by at least 20 per cent. The great reduction in the rate of increase in per capita demand that followed universal metering in other cities indicates that with general metering the average per capita rate of increase would not exceed 0.5 gallons per year.

Curve "Z" of Figure 5 was drawn on the supposition that if the city were fully metered by the year 1940 the normal demand would thereafter increase at the rate of 0.5 gallons per capita per year.

Estimated Future Consumption

The results of this study are compared graphically on Figure 6 with the present dependable supply from municipal sources, and the additional water that will be available after completion of the first and second stages of the Delaware project.

Without systematic waste control—both the first and second stages of the Delaware development would be required prior to 1945. Under these conditions the second stage would be insufficient to meet normal demands by 1963, and new sources of supply would be needed by that time. A serious water shortage would probably have occurred in 1935 except for effective measures previously undertaken by the Department of Water Supply to reduce house fixture and underground leakage. The

average daily demand, curve "B1", Figure 6, would result from the additional legitimate uses for water, such as air conditioning, etc., and not from increases in unnecessary waste or lavish use.

With underground leakage suppressed alone, the saving in water consumption is so small that the first stage of the Delaware would be inadequate by 1947, and the second stage would be unable to meet the demand by 1969. New sources must be found and developed prior to 1969, or Supreme Court permission obtained to divert more than 440 million gallons from the Delaware, if the city is to meet the expected normal demand without general metering. Figure 6, curve "B2".

With universal metering alone there would be a considerable reduction in consumption, but not enough to avoid developing the second stage of the Delaware prior to 1965. Figure 6, curve "B3A."

With universal metering and underground leakage suppressed the first installment of Delaware water would not be needed until 1954 and it would be possible to postpone the second stage of development until after 1970 without risk of a water shortage. Figure 6, curve "B3."

ECONOMICS OF WATER SUPPLY

Analyses made by the Department of Water Supply indicate that while some 23 per cent of the water consumed from municipal sources was metered in 1933, more than 75 per cent would have been so measured under universal metering. The remaining percentage would be accounted for by meter slippage, free water for public and charitable purposes, underground leakage that cannot be stopped economically, and water supplied to communities outside of New York City. On this basis water revenue under universal metering, and the income that would be derived under present methods of selling water were estimated and compared with indicated expenses for a 25 year period. See Tables 11 and 12.

With Universal Metering and Underground Leakage Suppression

Assuming that metering would be general in the city by the end of 1940, the total water expected to be consumed during the period July 1941 to July 1966 was determined on the basis of curve "B3", Figure 6.

Revenue from the sale of water was then estimated for each fiscal year, first, with rates now in force, which are 50 per cent above 1933 rates; and

secondly, with "old" rates that were effective prior to 1934. This revenue covers the sale of water from municipal sources only, about 75 per cent of which was assumed to be metered and consumed within New York City. Since the water used by outside communities is sold on the basis of delivery costs to the city, revenue from this source would be the same regardless of city conditions.

Expenses — Operation costs of the Department of Water Supply, Gas and Electricity (developed from the Finance Study, Volume III of this series of reports) were reduced to exclude the bureaus of gas and electricity. The resulting costs allow for the additional expense of systematic suppression of underground leakage. While the Board of Water Supply is primarily a design and construction agency, there are some continual overhead expenses that are not absorbed in cost estimates for the Delaware project, and were, therefore, included in this analysis.

In addition to service charges on existing water debt, the service on the estimated annual average cost of water main extensions, replacements and improvements to the system are included in debt service calculations. Service charges on new debt for the Delaware project were based on completion of the first stage in 1945 and the second by 1951,

and costs being financed by 50 year corporate stock with yearly installments calculated for sinking funds earning 3 per cent, and interest computed at 4 per cent per annum.

The Department of Water Supply estimates that general metering will cost 20 million dollars to put into effect, and that expenses thereafter for metering new buildings, replacements of old meters, etc., will amount to \$730,000 annually. In calculating debt service, the \$20,000,000 was assumed to be 20 year corporate stock outstanding July 1, 1941, and the \$730,000 being an annual recurrence was supposed to be financed by tax notes. The additional expenses of reading, billing and maintenance of water meters for the entire city is estimated at \$213,000 above present annual costs.

On this basis total expenses would amount to 1,353.26 million, which would leave an estimated balance of 15.86 million dollars with present water rates. If water should be sold at "old" rates, there would be a deficit of 423.43 million dollars, which would have to be met by revenue from other sources, probably real estate taxes. Table 11.

Without Systematic Waste Control and Present Methods of Selling Water

Assuming that the present method of distribution would continue, the total quantity of water

TABLE 11
With Universal Metering and Underground Leakage Suppression
Estimated Income and Outgo for Water Supply
July 1941 to July 1966
(Figures in Millions of Dollars)

Revenue	Present Rates		"Old" Rates	
1. From New York City	1,348.10		908.81	
2. From Outside Communities	21.02		21.02	
Total Revenue		1,369.12		929.83
<i>Expenses</i>				
1. (a) Department of Water Supply	527.69		527.69	
(b) Board of Water Supply	21.75		21.75	
2. Debt Service Charges				
(a) Present Debt	456.70		456.70	
(b) For Delaware Project	293.06		293.06	
3. Metering Costs				
(a) Debt Service	30.88		30.88	
(b) Meters for New Buildings	17.86		17.86	
(c) Additional cost of readings, billing, maintenance, etc.	5.32		5.32	
Total Expenses		1,353.26		1,353.26
Difference.....		15.86		423.43*
*Deficit				

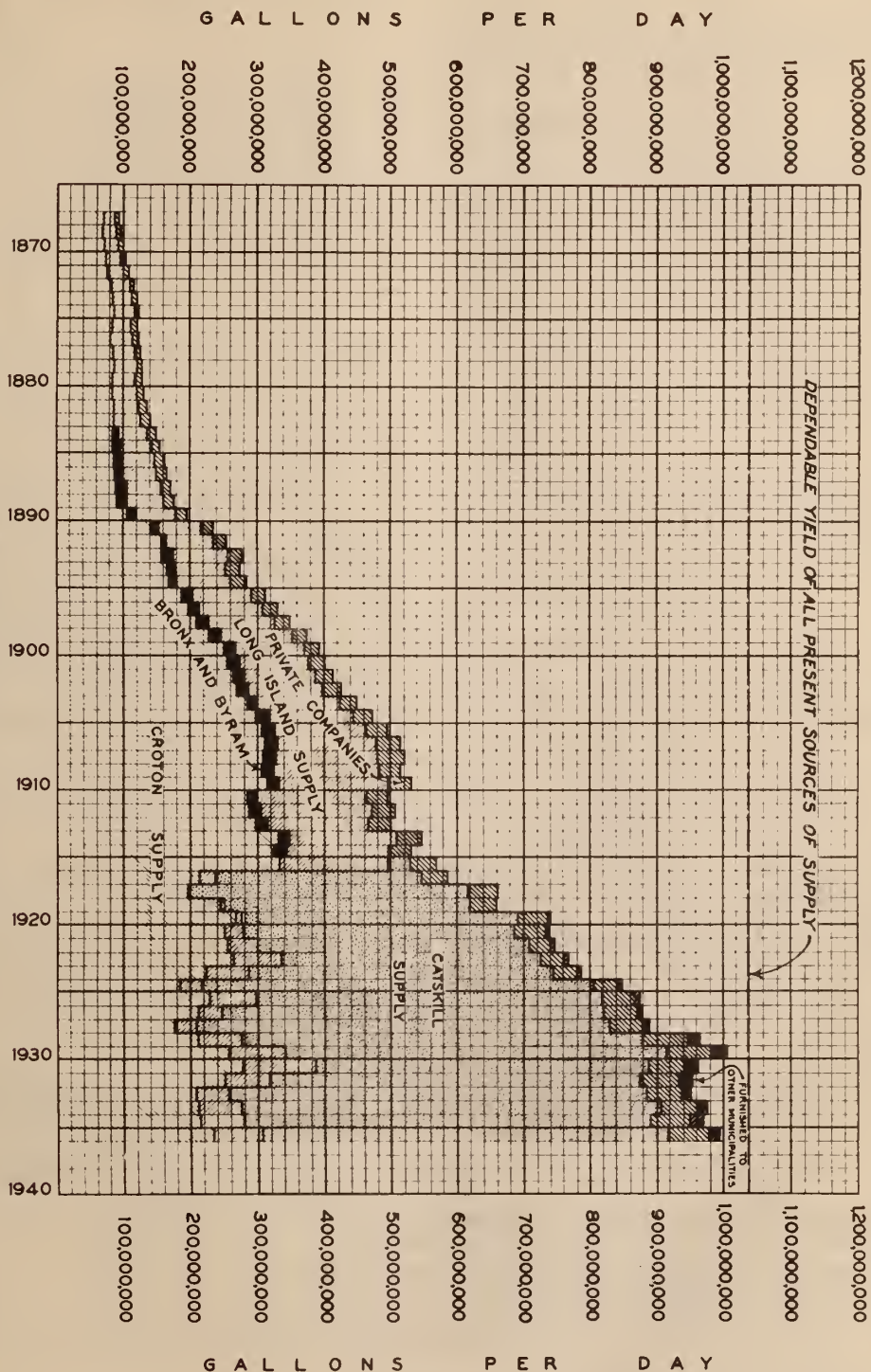
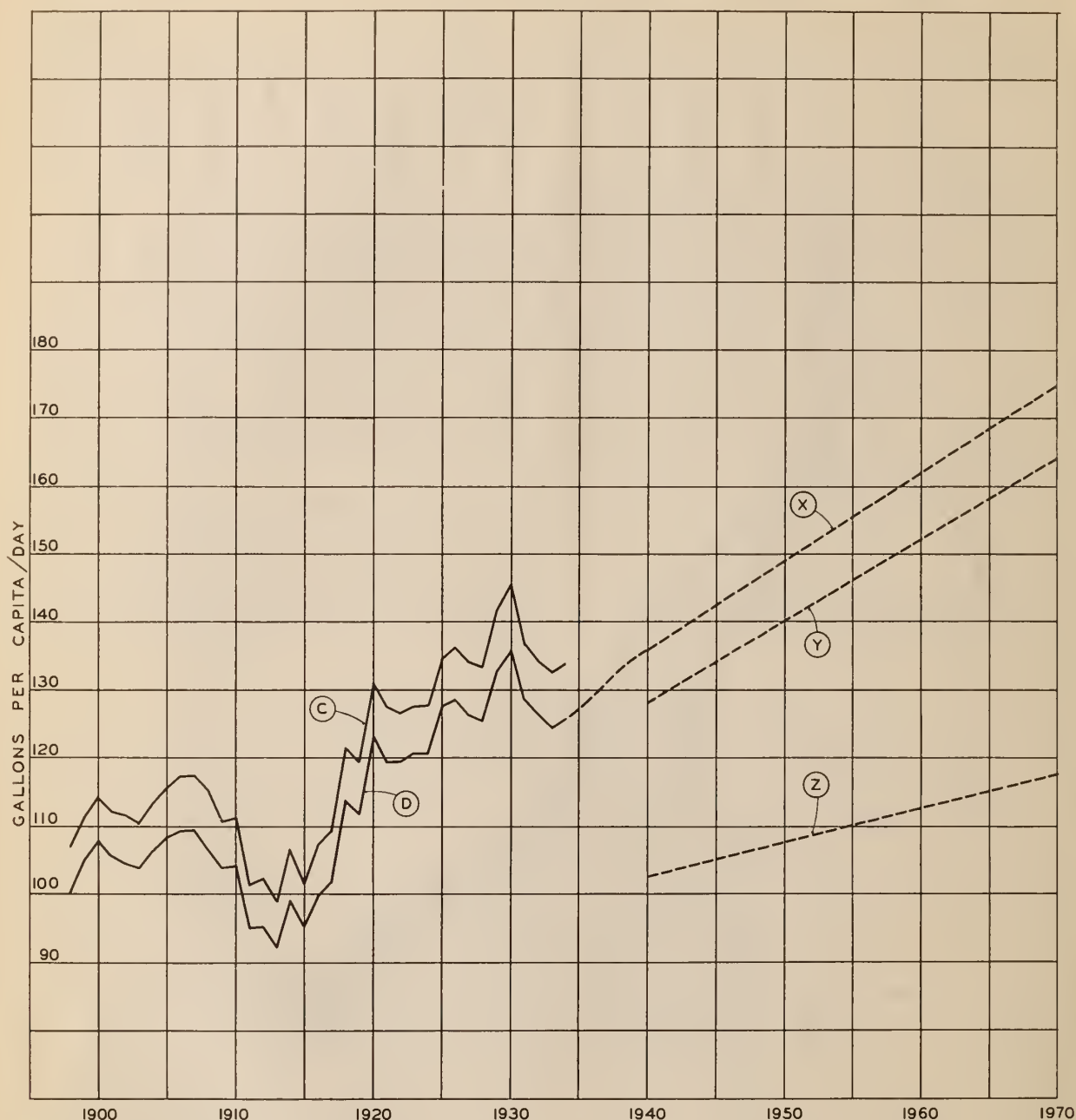


FIG. 4 PREPARED BY BD. OF WATER SUPPLY

AVERAGE DAILY PER CAPITA WATER CONSUMPTION



C - ADPC CONSUMPTION SUPPLIED FROM ALL SOURCES.

D - ADPC CONSUMPTION SUPPLIED FROM MUNICIPAL SOURCES. *

ESTIMATED ADPC NORMAL CONSUMPTION FROM MUNICIPAL SOURCES. *

X - WITHOUT WASTE CONTROL (f.1.3 GALS./YR.)

Y - WITH UNDERGROUND LEAKAGE SUPPRESSED (f.1.2 GALS./YR.)

Z - WITH UNDERGROUND LEAKAGE SUPPRESSED AND UNIVERSAL METERING (f.0.5 GALS./YR.)

NOTE:-

ADPC: AVERAGE DAILY PER CAPITA.

* INCLUDES SUPPLY TO COMMUNITIES OUTSIDE OF CITY.

POPULATION 1890 - 1930: U.S. CENSUS FOR NEW YORK CITY.

POPULATION 1930 - 1970: M.C.C.P. ESTIMATE.

WATER SUPPLY DATA 1898 - 1934: DEPT. WATER SUPPLY.

MAYOR'S COMMITTEE ON CITY PLANNING
W.P.A. PROJECT NO. 6037
MAY 1937

FIGURE 5.

to be consumed was determined on the basis of curve "B1", Figure 6, for the period July 1941 to July 1966.

Revenue was estimated for 23 per cent of the water from municipal sources being metered, and income from frontage charges was based upon the assumption that per capita revenue would continue the past trend and increase slightly each year. At present rates revenue was calculated at 1,368.76 million dollars of which 21.02 is expected from outside communities. At "old" rates the total revenue was estimated at 1,004.72 million dollars. Table 12.

Expenses—Operation costs of the Department of Water Supply, Gas and Electricity, shown in Table 11, were reduced by \$230,000 each year, which is the estimated cost of systematic suppression of underground leakage. Operation costs, or overhead of the Board of Water Supply remain the same as in the previous calculation.

Debt service charges would be the same, with the first and second stage of the Delaware development, but additional expenses for metering, shown as item 3 in Table 11, would be excluded.

On this basis, total expenses were estimated at 1,293.45 million dollars, with present rates, which would leave a surplus of 75.31 million after paying expenses. With "old" rates revenue would be 288.73 million less than the estimated expenses.

From this analysis it appears that whether or not we have universal metering, the total expenses of the water supply system will exceed the revenue that would be derived under the "old" rates.

CONCLUSIONS

While universal metering and systematic waste control would increase expenses by about \$60,000,000 for this 25 year period, there would be an ample supply of water with only the first stage of the Delaware, whereas without these devices the need for additional supplies and further heavy expenditures would have to be faced before 1963. Cost estimates for the third stage of the Delaware development are not available, but the capital outlay required for the second stage of the Delaware would exceed the additional \$60,000,000 needed for metering and underground leakage suppression.

In order to avoid further pumping from underground sources, and to make the city practically independent of well water, the dependable yield of which seems questionable, it is desirable to proceed with the second stage of the Delaware development starting in 1946.

Conservation

Without attempting to discuss all of the implications of the water supply problem, it seems

TABLE 12
Without Systematic Waste Control and Present Method of Selling Water
Estimated Income and Outgo for Water Supply
July 1941 to July 1966
(Figures in Millions of Dollars)

	Present Rates		"Old" Rates	
<i>Revenue</i>				
1. From New York City	1,347.74		983.70	
2. From Outside Communities	<u>21.02</u>		<u>21.02</u>	
Total Revenue		1,368.76		1,004.72
<i>Expenses</i>				
1. (a) Department of Water Supply	521.94		521.94	
(b) Board of Water Supply	21.75		21.75	
2. Debt Service Charges— same as Table 11	<u>749.76</u>		<u>749.76</u>	
Total Expenses		1,293.45		1,293.45
Difference		75.31		288.73*
*Deficit				

clear that we must face the need for conservation of our water resources in the future. Figures 3 and 4 show the rapid increase in both per capita and total water consumption that followed the completion of the Catskill system in 1917. These facts suggest that, unless measures are taken to eliminate waste and the needless use of water, the introduction of the Delaware supply will be followed by similar rates of increase. In order to meet this ever increasing demand for water it will be necessary to enlarge the future dependable supply from time to time.

The additional sources of water supply that can be economically developed and made available to New York City are limited. For example, the dependable yield of the proposed third stage of the Delaware project is estimated at only 160 million gallons daily. It is evident that a reduction in the rate of increase of water consumption, through reasonable measures of control, is essential if we are to avoid further costly developments for additional sources of supply.

From the economic viewpoint, this study indicates that the immediate need for developing the first stage, and eventually the second stage of the Delaware will increase the costs of delivering water to New York City. The costs of developing any additional sources of supply will inevitably result in further increases in the costs of water supplied to the city, regardless of the means used to raise the necessary revenue.

In order to keep the water supply system on a sound financial basis, it is apparent that charges practically equal to present water rates must be maintained, at least until the retirement of the growing water debt is sufficient to reduce the amount of annual debt service charges.

The staff concluded that *universal metering* is not only desirable but essential to conserve the city's natural and financial resources, and that the necessary legislation should be secured at the earliest possible date. If a general metering program were commenced in 1939, it could be completed during the year 1942. Inasmuch as systematic suppression of underground leakage and universal metering would render the first and second stages of the Delaware project adequate until after 1970, if not for all time, the adoption of both of these measures should receive serious consideration.

Operating Costs

According to these analyses, the additional cost of reading, billing and maintenance of water meters, and the cost of underground leakage suppression, can be met by revenue from the sale of water at present rates. See Tables 11 and 12. The reduction in total water consumed under these measures of control may be expected to effect savings in the estimated costs of water main extensions, and in the ultimate cost of sewage disposal. See report on the Sanitation Study.

Capital Costs

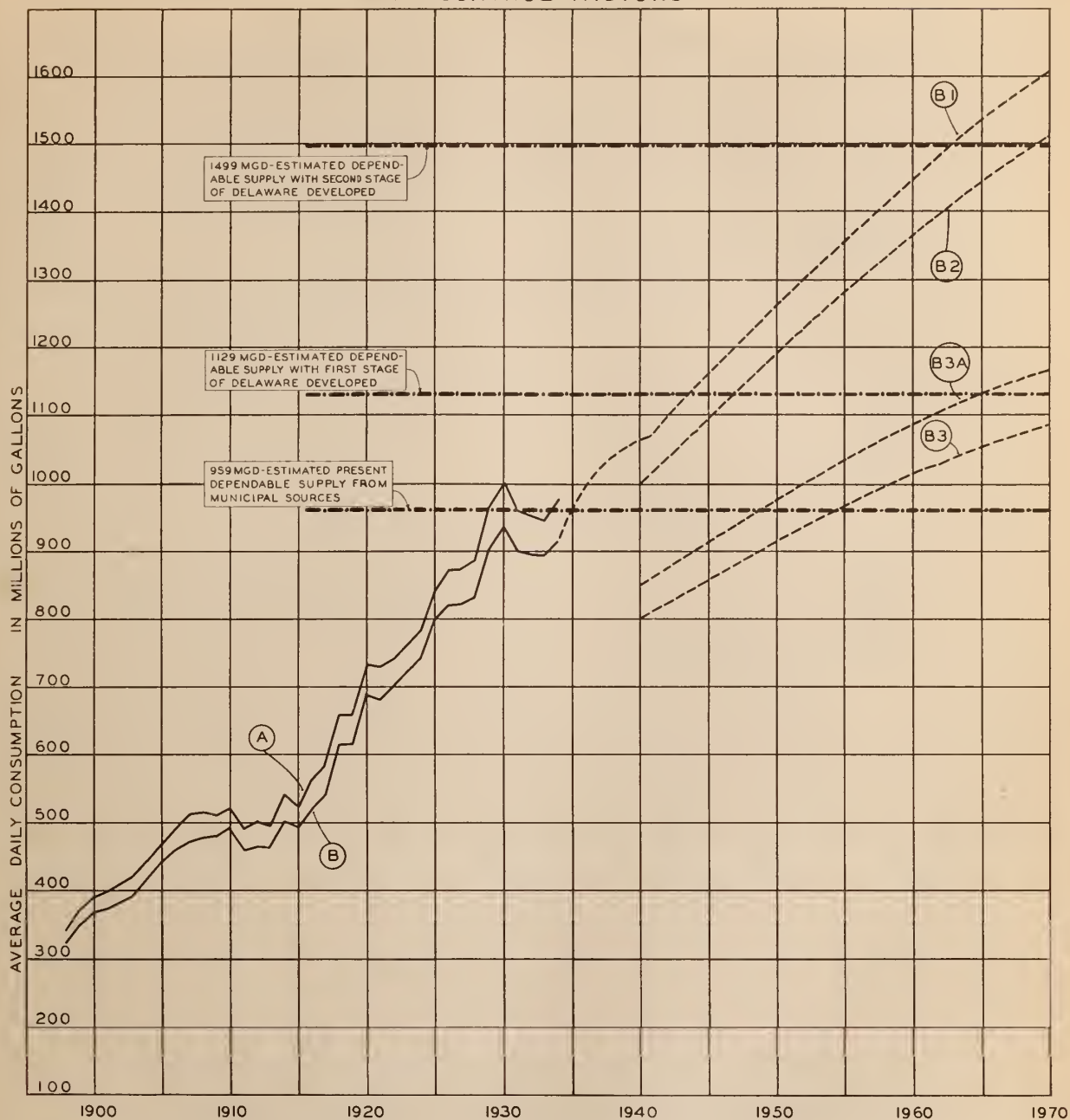
The estimated capital outlays required for water supply on the basis of these findings are given here for three 6-year periods. As was done in the Finance Study, the staff assumed that outlays for water supply authorized in the 1936 and 1937 capital budgets would be expended by January 1, 1939. In addition, it was supposed that expenditures to be made during the nine months of the 1938 capital budget would bring the total spent for the Delaware project, prior to the 1939 capital budget to nearly 61.5 million dollars, leaving a balance of about 148.7 million dollars necessary to complete the first stage. Under present schedules, the first stage of development will be finished during 1945; hence it was assumed that 138.75 million dollars will be needed during the first 6-year period. The remaining 10 million dollars, to provide for the completion of the first stage in 1945, was included in the second 6-year period.

While expenditures of nearly 184 million dollars are suggested for the first 6-year period, and approximately 100 million for the second, only slightly more than 27 million dollars of capital outlays are needed during the third 6-year period.

According to this study, however, the large expenditures for the first and second stages of the Delaware project, and for universal metering would provide the city with a supply of water that will probably be adequate for all time. On this basis it would not be necessary to repeat such large outlays or to continue any such rate of expenditures after the year 1956.

With universal metering and systematic suppression of underground leakage, the average amount of capital outlay needed for new meters, replacements and maintenance of meters, and for normal improvements to the water distribution system, is unlikely to exceed 4 million dollars annually after 1956.

TOTAL AVERAGE DAILY WATER CONSUMPTION WITH CONTROL FACTORS



A- AVERAGE DAILY CONSUMPTION FROM ALL SOURCES #

B- AVERAGE DAILY CONSUMPTION FROM MUNICIPAL SOURCES *

ESTIMATED NORMAL CONSUMPTION FROM MUNICIPAL SOURCES

B1- NO WASTE CONTROL

B2- WITH UNDERGROUND LEAKAGE SUPPRESSED

B3- WITH UNDERGROUND LEAKAGE SUPPRESSED AND UNIVERSAL METERING

B3A- WITH UNIVERSAL METERING ONLY

WATER SUPPLY DATA 1898-1935: DEPT. WATER SUPPLY

* INCLUDES SUPPLY TO COMMUNITIES OUTSIDE OF CITY

FIGURE 6.

MAYOR'S COMMITTEE ON CITY PLANNING
W.P.A. PROJECT NO. 6037
MAY 1937

Suggested Capital Outlay Program

For the first 6-year period, 1939 to 1944 inclusive

1. First stage of the Delaware development	\$138,750,000
2. Universal metering, initiated during 1939-1942	20,000,000
3. Cost of meters for new buildings, replacements and maintenance of meters— 2 years @ \$730,000	1,460,000
4. Normal improvement to distribution system ⁽⁵⁾	18,900,000
5. Bureau of Gas and Electricity ⁽⁶⁾	4,800,000

Total capital outlay.... \$183,910,000

For the second 6-year period, 1945 to 1950 inclusive:

1. Complete first stage of the Delaware project	\$ 10,000,000
2. Second stage of the Delaware development	62,413,000
3. New meters, replacements and maintenance	4,380,000
4. Normal improvement to distribution system ⁽⁵⁾	18,000,000
5. Bureau of Gas and Electricity ⁽⁶⁾	4,800,000

Total capital outlay... \$ 99,593,000

For the third 6-year period, 1951 to 1956 inclusive:

1. New meters, replacements and maintenance	\$ 4,380,000
2. Normal improvements to distribution system ⁽⁵⁾	18,000,000
5. Bureau of Gas and Electricity ⁽⁶⁾	4,800,000

Total capital outlay.... \$ 27,180,000

(5) The Department of Water Supply, Gas and Electricity estimates the average cost of water main extensions to supply new buildings, etc., special trunk main extensions and improvements to the distribution system at \$3,000,000 annually. The additional \$900,000 in the first period covers needed pumping plants.

(6) The city has recently initiated a policy of purchasing and installing street and park lighting fixtures under the supervision of the Bureau of Gas and Electricity. Therefore, this item of capital outlay, estimated at \$800,000 annually is included under water supply.

Sanitation

INTRODUCTION

In a city of seven million people, the disposal of ashes, garbage, rubbish and sewage creates serious problems and involves considerable expense. Water pollution, a potential health menace, has rendered much of the city's waterfront unfit for recreation, residential purposes and certain types of commercial fishing. Consideration of sanitation problems as they affect physical improvements and capital outlays is of primary importance in a city planning program.

This phase of the Mayor's Committee studies was concerned with an appraisal of the city's needs in the light of the probable ultimate population and the estimated cost of necessary permanent improvements. The Department of Sanitation furnished information to the staff on methods and facilities for disposal.

REFUSE

In this study the term "refuse" includes ashes, which are used for land fill; and garbage and rubbish which were assumed to be disposed of by incineration. The disposal of offal is effected through private concerns that process animal by-products and, therefore, was not considered.

From some 5.3 million cubic yards, or 1.43 cubic yards per capita, in 1902, the annual quantity of refuse collected increased to about 21.5 million cubic yards by 1935, or 2.9 cubic yards per capita. The amount of ashes collected each year decreased at the rate of $\frac{1}{2}$ of one per cent per annum to 45 per cent of total refuse in 1936. Assuming an average per capita increase of 0.06 cubic yards per annum, the staff estimates that 46.2 million cubic yards or about 10.5 million tons of refuse will be collected during the year 1970, of which 28 per cent, or some 4.5 million tons would be ashes.

Ash Disposal

The excellent work recently done by the Department of Sanitation on landfills suggests the possibility of using this vast quantity of ashes in the future to reclaim low lands for public use in accordance with a well conceived master plan for city development.

Rubbish and garbage—which the city can no longer dump at sea and hence are termed "com-

combustible refuse" herein — collected from 1902 to 1936, was translated to per capita figures and plotted. Figure 7 indicates the past quantities as well as the estimated per capita and total amounts in cubic yards to be disposed of in the future.

The amount of combustible material to be collected in 1970 will probably be equivalent to nearly 6 million tons (after making due allowance for the different densities of rubbish and garbage and the proportion of each included in the total quantity) which, compared with the 2.216 million ton annual capacity of existing incinerators, indicates the need for new plants with an additional capacity of about 11,900 tons per day. On the supposition that plants rated at 750 tons daily capacity are generally the most efficient, it would be necessary to build 16 new incinerators by 1970, or approximately one plant every two years at an estimated average cost of \$1,690,000 each for land and construction.

SEWAGE DISPOSAL

While the sewage disposal problem has been studied for a number of years, relatively little progress has been made in the abatement of pollution of the waters about New York City. As early as 1905 the pollution of harbor waters was brought to public attention by the New York Bay Pollution Commission. Again in a 1914 report, the Metropolitan Sewerage Commission stated that "the crude sewage of a population of over 6 million persons is discharged into the harbor without purification, regulation or control. The discharges discolor the water, pollute the shores, produce offensive deposits and cause solid matters, plainly recognizable as of sewage origin, to float about in plain sight. Bathing and the taking of shellfish for food are no longer safe north of the Narrows." This Commission strongly recommended improvement of these conditions.

The Sanitary Commission of New York City recommended in 1931 "General Plans for Sewage Disposal" for the city including an extensive construction program for disposal plants. This Commission recognized that a number of years would be required to overcome pollution from New York City's sewage, and that no satisfactory results can be obtained without the cooperative treatment of sewage from other communities that contribute to the pollution of harbor waters. The first pro-

ject in this program, the Wards Island treatment plant, commenced to operate shortly after completion of this study in March 1938.

The report of the Tri-State Treaty Commission, published in 1932, indicated that the pollution of metropolitan waters not only constituted a grave menace to the health, welfare and recreational facilities of the population, but resulted in great economic loss, and that the abatement of existing and the control of future pollution was of prime importance. This report stated that New York City was responsible for about 77 percent of the sewage reaching the tidal waters of New York Harbor, and that plans of the Sanitary Commission for treatment of the city's sewage "will go far to provide for present and future conditions, but they will not produce the required improvement unless supplemented with treatment of sewage reaching these waters from other areas". Following this report the Interstate Sanitation Commission was created to promote cooperation and agreements between New Jersey, New York and Connecticut for the abatement of pollution. However, the state of Connecticut had not become a party to an anti-pollution compact at the time of writing.

Present Program

The Interstate Sanitation Commission has apparently not yet considered any detailed plan for New York City, but prior to 1938 the Department of Sanitation developed studies for several specific projects in accordance with its "Tentative Plan for Sewage Disposal" dated October 1937. Under the charter the construction of sewage treatment plants is transferred to the newly established Department of Public Works.⁽⁷⁾ Figure 8 reprinted through the courtesy of the Department of Public Works, shows graphically the 38 projects which will be designed to care for the needs of the entire city. Each of these projects will be adapted to local needs with special emphasis on the required degree of purification. The Sanitation Department estimates that only 18 percent of the city's sewage received even limited treatment during 1936 and that 72 percent, entirely untreated, was discharged into surrounding waters. The new Wards Island and Coney Island plants are now operating; as are other old plants employing fine screens which give an unsatisfactory degree of treatment.

Consideration of the engineering problems involved, as well as the degree of purification desirable in various waters, was definitely beyond

the province of the Mayor's Committee study. The staff did not attempt to evaluate this tentative plan beyond its relation to estimated population and the relative urgency of sewage disposal projects in relation to other needs to be included in the suggested capital outlay program.

Probable Needs

The total future flow of sewage that would be treated by the 38 plants according to Figure 8, amounts to 1,782 million gallons daily. Since this plan is tentative it is of interest to compare staff estimates with this figure for total flow. According to information given in the Tri-State Treaty Commission's report, the estimated sewage flow in 1930 was equivalent to 140.7 gallons per capita per day, or 96.9 percent of the water consumption, amounting to 145.2 gallons per capita per day. Water consumption figures are from the Water Study. The Mayor's Committee staff estimates the water consumption for the year 1970, with no measures of control, at 1,612.8 million gallons daily. See Figure 6. If the staff estimate is valid and the 1930 ratio should apply, the total resulting sewage flow to be treated during 1970 would amount to about 1,560 million gallons daily, which is some 200 million gallons less than is indicated on Figure 8. With universal metering this quantity of sewage would be further reduced to about 1,050 million gallons daily.

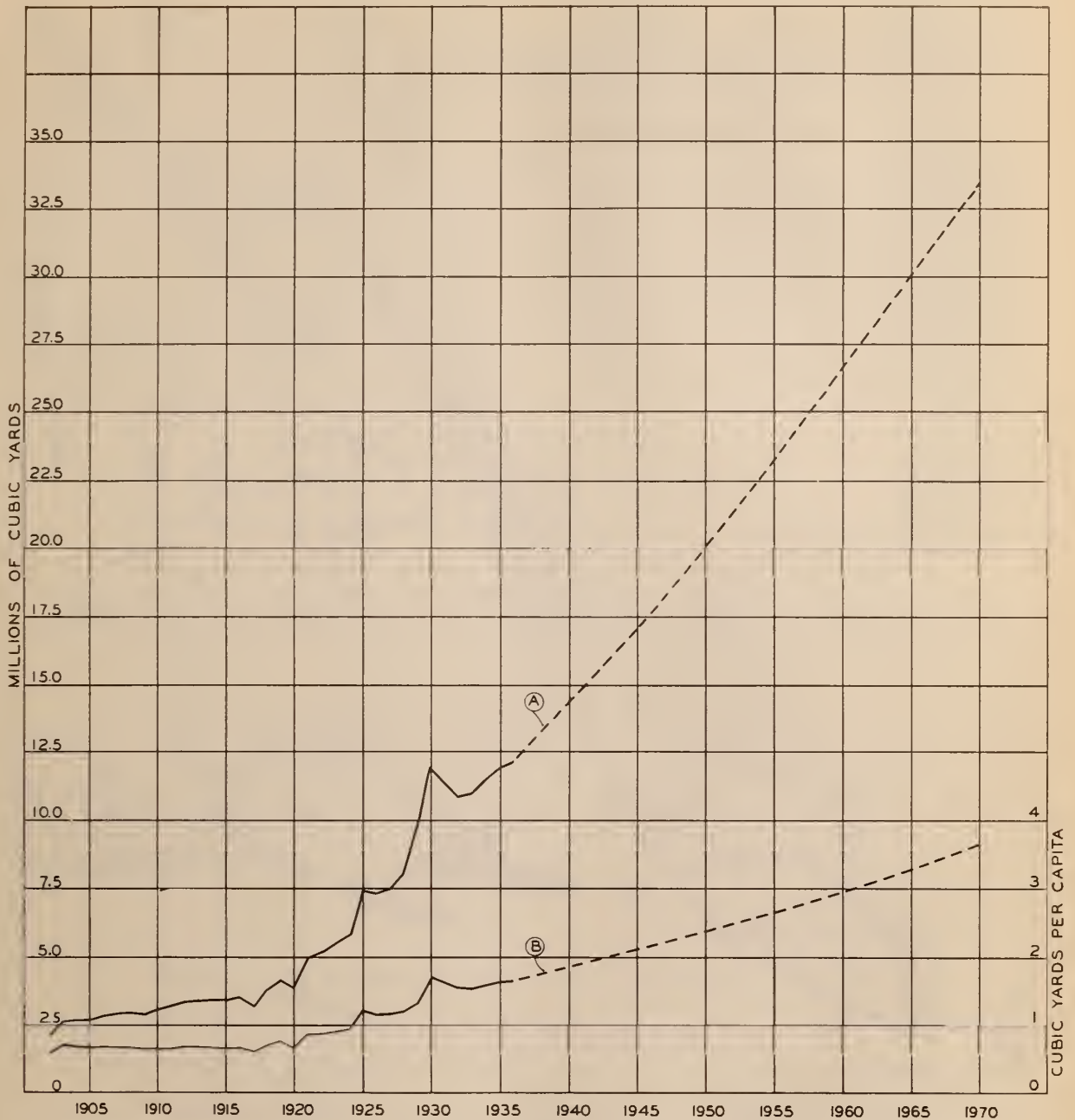
While this affords only the most general sort of comparison and does not throw any light on the necessary size of individual plants, the variance suggests the desirability of close cooperation between the new City Planning Commission and the Department of Public Works in developing plans for sewage disposal.

Estimated Future Costs

On the basis of preliminary figures the treatment works shown on Figure 8, with the necessary intercepting sewers, are estimated to cost about 200 million dollars, excluding the costs of land and rights-of-way. According to the Department of Public Works this estimate includes some \$150,000,000 for plants with a daily capacity of 1,280 million gallons to meet present deficiencies, and \$50,000,000 for the ultimate expansion of these plants to provide for the estimated future flow. If the expenditures author-

(7) Since the completion of this Study in March, 1938 the Department of Public Works has modified the Tentative Plan of 1937.

COMBUSTIBLE REFUSE COLLECTED



A - TOTAL COMBUSTIBLE RUBBISH AND GARBAGE COLLECTED
 B - COMBUSTIBLE RUBBISH AND GARBAGE COLLECTED PER CAPITA

NOTE:

DATA FOR 1902-1936 FROM DEP'T. OF SANITATION

ESTIMATES FOR 1936-1970 BY STAFF OF M.C.C.P.

MAYOR'S COMMITTEE ON CITY PLANNING
 W.P.A. PROJECT NO. 6037
 MAY, 1937

FIGURE 7.

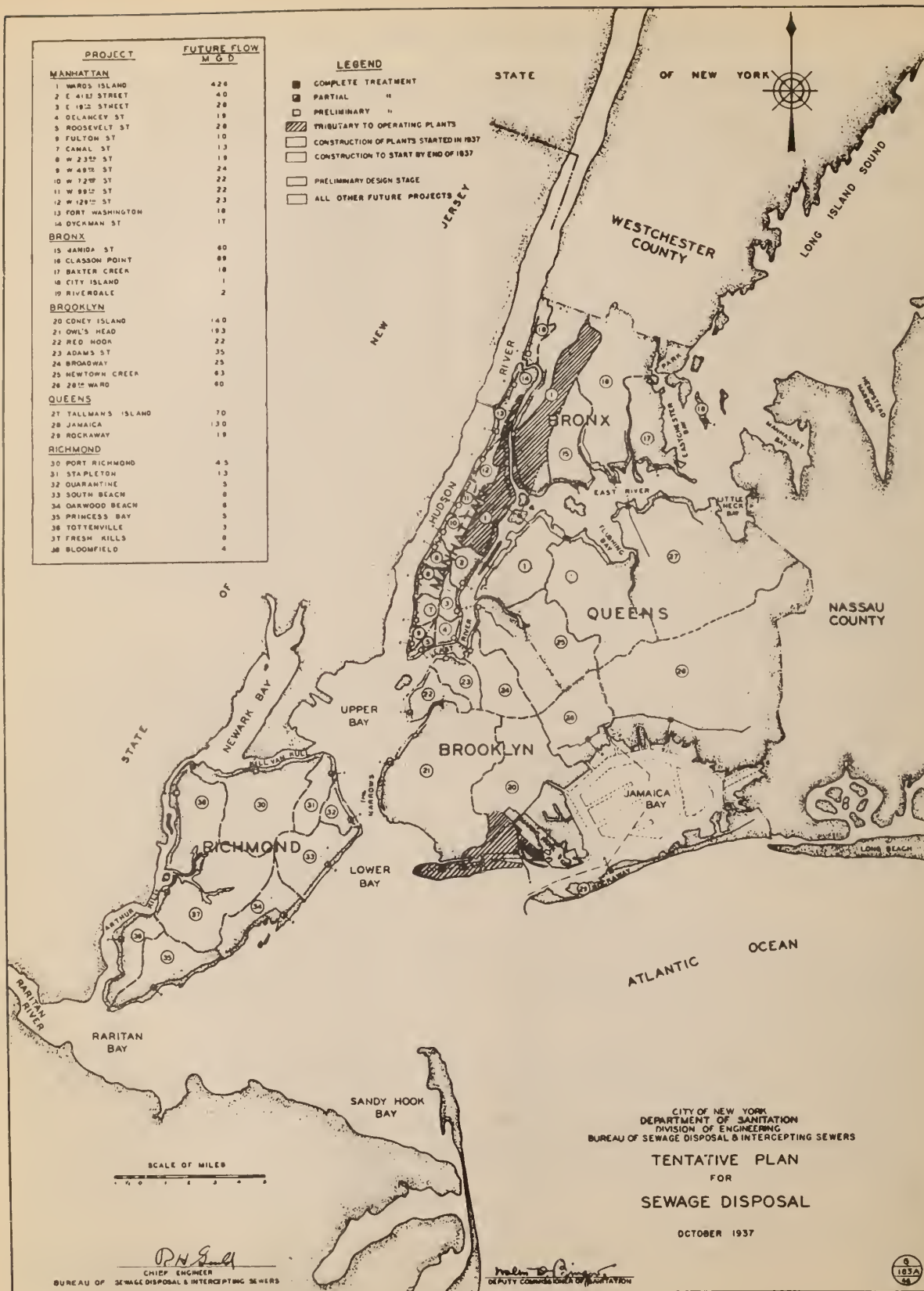


FIGURE 8

ized for the Wards Island, Coney Island and Tallman's Island plants are deducted from the above total, a balance of approximately 117 million dollars would be required for the construction of additional plants to furnish treatment for present sewage flow, or about 167 million dollars for the future flow indicated by Figure 8.

Although a reduction of 200 million gallons in the required ultimate daily capacity would probably not materially reduce the above cost estimate, the staff assumed that 167 millions of dollars would cover the total cost of needed facilities, including land and rights-of-way. If water metering should be made general the reduction in the daily capacity of treatment works required by 1970 would probably amount to more than

700 million gallons of sewage. Lacking any assurance that metering will become general, it was believed more conservative to use the figure of 167 millions of dollars in this study.

OTHER SANITATION IMPROVEMENTS

In addition to incinerators and sewage disposal projects, there are other types of permanent improvements that will be required for the proper handling of the city's sanitation problems. These improvements include such projects as garages and storage buildings, waterfront dumps, unloading plants, refuse scows, etc., and necessary land acquisition.

Inasmuch as the staff lacked the data essential to a determination of future needs for such facili-

Suggested Capital Outlay Program

Expenditures for the 6-year period, 1939 to 1944 inclusive:

1. Incinerators for the disposal of combustible refuse ⁽⁸⁾	\$ 5,070,000
2. Sewage disposal plants and intercepting sewers ..	55,500,000
3. Miscellaneous projects	2,184,000

Six year total ... \$ 62,754,000

Expenditures for the 6-year period, 1945 to 1950 inclusive:

1. Incinerators for the disposal of combustible refuse ⁽⁸⁾	\$ 5,070,000
2. Sewage disposal plants and intercepting sewers	55,500,000
3. Miscellaneous projects	2,304,000

Six year total ... \$ 62,874,000

Expenditures for the 6-year period, 1951 to 1956 inclusive:

1. Incinerators for the disposal of combustible refuse ⁽⁸⁾	\$ 5,070,000
2. Sewage disposal plants and intercepting sewers	55,500,000
3. Miscellaneous projects ..	2,400,000

Six year total ... \$ 62,970,000

(8) Based upon the assumption that one plant should be built every two years.

ties, the probable extent of capital outlays required for these miscellaneous items was based on past expenditures. From an analysis of available figures in the Comptroller's Reports it appears that an average of 4.6c. per capita per annum was expended upon such items during the eight years prior to 1932.

Probable Future Expenditures

Assuming that future requirements can be met by a per capita outlay equal to this past average, the staff estimates that an average of \$364,000 per year will be needed during the six years prior to 1945; about \$384,000 per year for the second 6-year period; and \$400,000 per year during the third 6-year period ending in 1956.

While this type of estimate does not compare with the careful analysis made in other steps of this study, which indicated the expected physical needs of the city, it does furnish a fairly reasonable basis for considering the extent of expenditures for miscellaneous sanitation projects that may be required in the future.

SUMMARY OF FINDINGS

A program for the construction of sanitation projects indicated as needed by this study, is sug-

gested in the following schedules of expenditures for three 6-year periods. If we should assume that annual expenditures for sewage disposal could be spread equally over the period 1939 to 1970, the yearly outlay would amount to about 5.2 million. However, the staff concluded that the abatement of water pollution was so important from both a social and economic viewpoint, that it should receive preferential consideration in the suggested capital outlay program, provided that the other communities responsible for pollution in this area do their share toward the abatement of this nuisance. Assuming that the entire program can be completed in eighteen years, the average outlay would amount to about 9.25 million dollars annually for the period ending 1956.

Although the expenditures suggested in this program are virtually identical throughout the eighteen year period, the sewage treatment works included therein are expected to provide for the city's ultimate needs. On this basis it would be unnecessary to continue such large scale expenditures after 1956. Starting with 1957, the average capital outlay required for additional incinerators and miscellaneous sanitation projects would probably not exceed 1.25 million dollars per year.

Education

INTRODUCTION

Educational policy and teaching methods will doubtless undergo progressive changes in the future, but there can be no question regarding the city's needs for adequate school facilities. Obsolete structures must eventually be replaced and the school plant extended to meet present deficiencies and future requirements.

This study is divided into six parts: (1) estimates of the population of school age; (2) requirements for elementary schools; (3) requirements for high schools; (4) college facilities; (5) indicated capital expenditures; and (6) suggested capital program. In this chapter "elementary" refers to both elementary and junior high schools; "secondary" refers to high schools only. While primarily concerned with the probable future registration in *public* elementary and secondary schools, this study analyzed parochial school registration figures in order to determine trends and to account for the school attendance of all children of school age.⁽⁹⁾

School adequacy and location are so definitely related to the urban pattern of living that the school problem can not be satisfactorily studied without due consideration of each determining factor. However, limitations of time and resources have made it necessary to confine this study mainly to general evaluations of city-wide physical requirements for public schools as evidenced by the population distribution indicated by the staff's conclusions as to Residential Areas⁽¹⁰⁾, and the number of children within the age groups that will attend public schools; and secondly, the expected registration by school district as a measure of elementary school needs. Due to the type of information available, college facilities and contingent items were treated differently, as will be explained in the following pages.

POPULATION OF SCHOOL AGE

The first stage of this study was limited to a determination of the number of children of school age that were "available" for school between 1920 and 1935, and the proportion of "available" chil-

dren registered in school. The next step was to forecast the probable future school attendance.

It was assumed that the age group 5 to 13 years inclusive would represent the children "available" for elementary school, and that the age group between 14 and 18 years inclusive would represent the children "available" for secondary school.

Children Available for Elementary School 1920 to 1936

The population study of the Mayor's Committee staff supplied the basic data on death and birth rates, and population distribution.⁽⁹⁾ Employing the "moving average birth rate" method, the staff estimated the number of children that were born and the percent that died each year, to obtain the number 5-13 years old that were available for school each year during 1920 to 1935.

This method is illustrated by the following example: Birth rates for the years 1907 through 1915 were used to determine the number of children born that would have been of school age (5-13 years) in the school year 1920-1921. From the reported number of deaths in this age group, the percent that died prior to 1920-1921 was obtained for each year. On this basis the number of children available for school in 1920-1921 was determined.

The identical method, employing known data for each year, was used to obtain children available for each succeeding school year up to 1936-37. The percent of children available that actually registered in the city's public and parochial elementary schools was obtained from official reports for each school year between 1920-21 and 1935-36. A comparison of the estimated children available with the reported registrations in public and parochial elementary schools is shown by the figures in Table 13. Of the children available in 1920, it was found that 95.49 percent registered in public and parochial schools; by 1935 the combined registration was equal to 99.18 percent of children available. Since 1920, public school registration has averaged 82.9 percent of children available. Reference to the table will show that

(9) The original report on the Education Study was completed in October 1938.

(10) See Volume I—Mayor's Committee on City Planning Report, "Basic Factors in the Planning of the City of New York."

TABLE 13
Children Available, 5-13 Years Old, and Public and
Parochial Elementary School Registration

School Year	Children Available	Registration			% Children Available Reg. in Public School
		Parochial	Public	Total	
1920-21	974,175	144,985	785,213	930,198	80.61
1921-22	997,072	150,013	811,490	961,503	81.39
1922-23	1,017,477	153,981	822,305	976,286	80.82
1923-24	1,039,677	157,290	837,679	994,969	80.57
1924-25	1,048,327	161,862	844,562	1,006,424	80.57
1925-26	1,053,405	165,131	848,598	1,013,727	80.54
1926-27	1,059,733	167,225	855,784	1,023,009	80.75
1927-28	1,062,079	170,330	865,112	1,035,442	81.45
1928-29	1,059,080	171,358	869,219	1,040,577	82.07
1929-30	1,056,235	173,232	874,810	1,048,042	82.85
1930-31	1,055,055	174,782	877,989	1,052,771	83.23
1931-32	1,049,384	172,618	872,916	1,045,534	83.17
1932-33	1,044,225	172,453	870,812	1,043,265	83.40
1933-34	1,046,054	172,396	865,691	1,038,087	82.76
1934-35	1,043,773	173,357	857,273	1,030,630	82.13
1935-36	1,037,895	172,493	856,990	1,029,483	82.56

since 1929, the estimated number of children available has declined, due to the falling birth rate, although total registration did not commence to decline until 1931.

Parochial school registration increased from 14.88 per cent of children available in 1920 to 16.67 per cent by 1935. The relatively small number of children available (less than one per cent in 1936) that did not register in public or parochial schools probably attended private elementary schools, or are otherwise unaccounted for by this analysis.

Children Available, 5-13 Years of Age, 1936 to 1970

The "moving average birth rate" method was also employed to estimate the children who may be available in the future. Reported birth rates as well as the staff's predicted birth rates (which will drop from 14 per thousand population in 1937, to 10 per thousand population by 1965) were employed in this estimate. For the years 1936 to 1970 inclusive, the average death rate was obtained from the staff's curve extension. Figure 9. The reported annual average death rate for the age group 5-13 years dropped from 17.9 per cent in 1920 to 9.2 per cent in 1936. The predicted rate would continue this downward trend, declining to 5 per cent by 1960 and remaining constant thereafter. The number of children that would be available on this basis is given in Table 14.

Future Elementary School Registration

Having forecast the number of children available, the staff then calculated the public and parochial school registration for each year up to 1970, on the assumption that 82.9 per cent of the children available will register in public schools and 16.1 in parochial schools. Table 14 and Figure 9.

Although the extension of the birth rate and average death rate curves were considered conservative, the number of children that would be available on this basis declined from about one million in 1935, to less than 784,000 by 1970. With this expected drop in the number of children available, public elementary school registration is estimated to decline from 115.5 children per thousand population in 1935 to 70.5 children registered per thousand population by the year 1970. Figure 10.

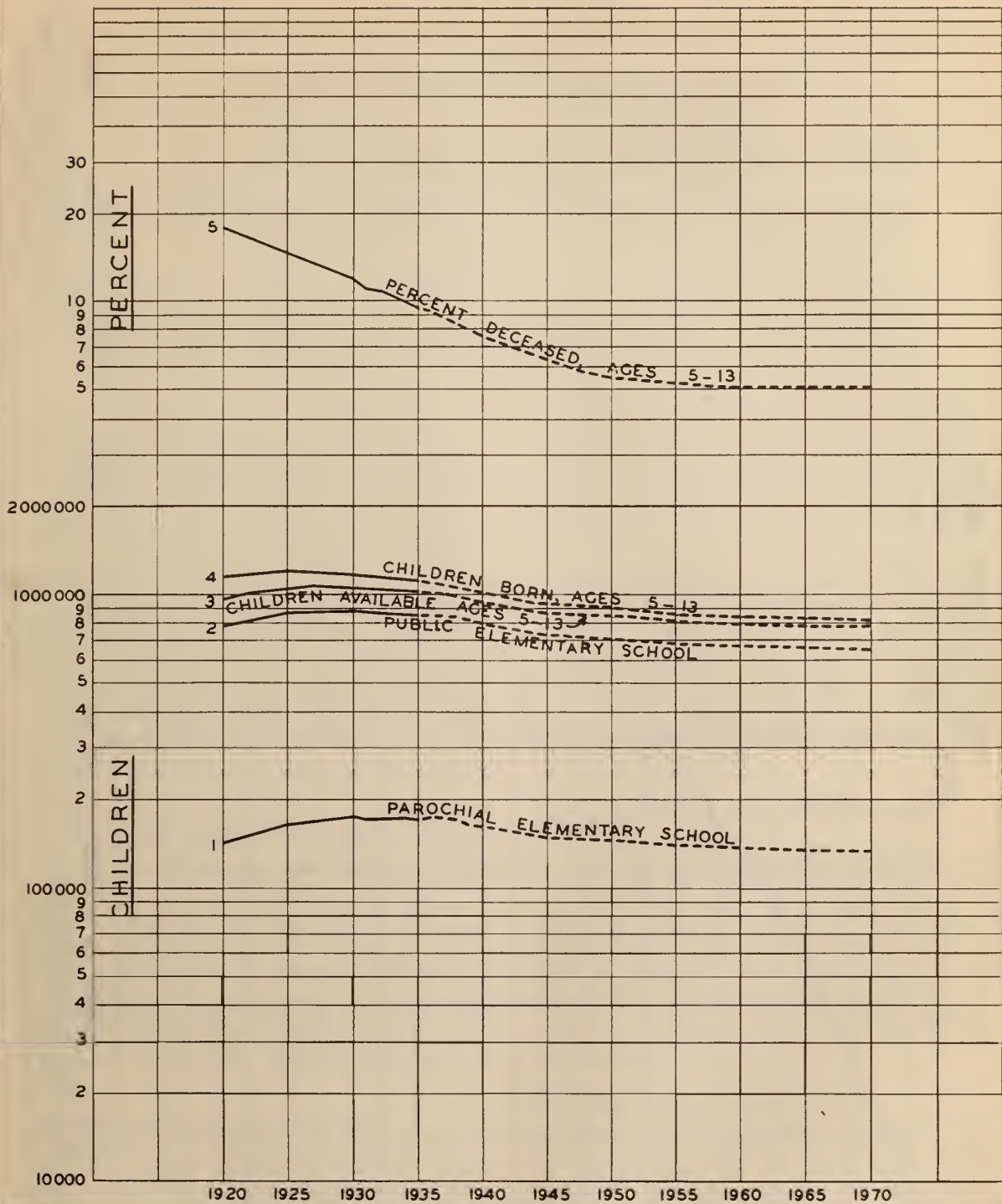
While this forecast is subject to qualifications and will doubtless require modifications as future data reveal alterations in current trends, it was believed to furnish a realistic basis for considering the city's school needs. See Figure 12 and footnote 10.

Children Available for Secondary Schools, 1920 to 1936

Using reported birth rates and death rates, the staff also employed the "moving average birth rate" method to estimate the children available

ELEMENTARY SCHOOL DATA - NEW YORK CITY 1920-1970

B5-4



SOURCE OF INFORMATION FROM 1920 TO 1935

1. CATHOLIC SCHOOL BOARD.

2. AVERAGE DAILY REGISTRATION-BOARD OF EDUCATION

3 4 5 BOARD OF HEALTH STATISTICS.

FROM 1935 TO 1970 - ESTIMATED BY M.C.C.P.

FIG. 9

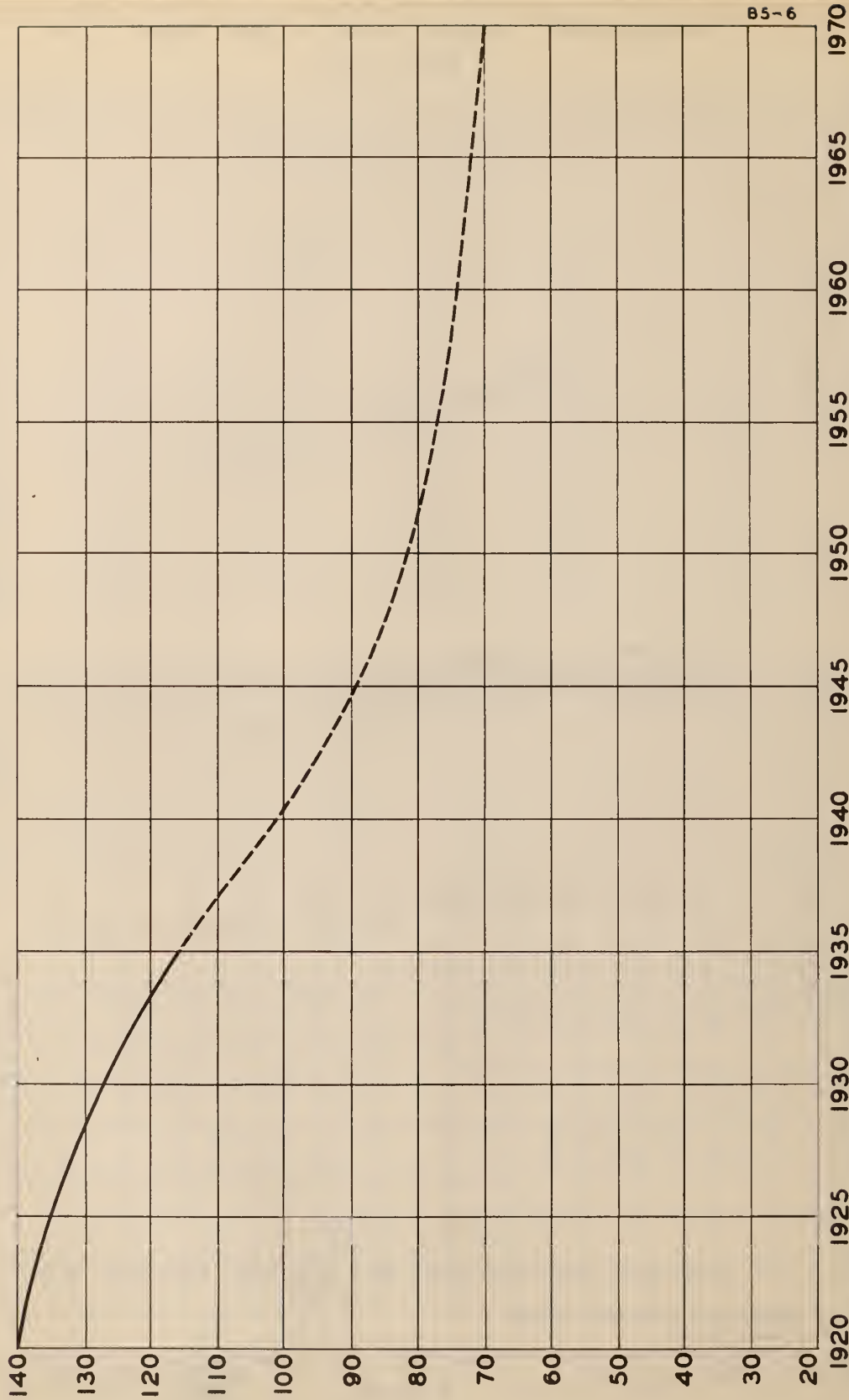
MAYOR'S COMMITTEE ON CITY PLANNING

PROJECT NO. 165-97-6999

(6037-1022) (OLD 319)

MARCH, 1937

PUBLIC, ELEMENTARY AND JUNIOR HIGH SCHOOL CHILDREN PER 1000 POPULATION NEW YORK CITY...1920 - 1970



85-6

SOURCE OF INFORMATION FROM 1920 TO 1935 -
BOARD OF EDUCATION & BOARD OF HEALTH.
FROM 1935 TO 1970 - ESTIMATED BY M.C.P.

FIG. 10.
APRIL 1937.

MAYORS COMMITTEE ON CITY PLANNING
PROJECT NO. 165-97-6999
(6037-1022) (OLD 319)

TABLE 14
Estimate of Future Children Available and Elementary School Registration

School Year	Children Available	Registration		
		Total	Parochial School	Public School
1937-38	1,016,986	1,006,816	164,111	842,705
1940-41	955,831	946,275	154,243	792,032
1945-46	870,425	861,721	140,461	721,260
1950-51	852,516	843,991	137,571	706,420
1955-56	813,324	805,191	131,246	673,945
1960-61	799,576	791,582	129,029	662,553
1965-66	790,060	782,159	127,492	654,667
1970-71	783,425	775,591	126,421	649,170

for high school. The results of this analysis are given in Table 15, as well as the secondary school registration figures. There were no city-wide data available for parochial high schools between the years 1920 and 1928. However, this table indicates that both the number, and the percent of children available who were registered in secondary schools, have steadily increased since 1920. That portion of available children not accounted for by these figures probably attended private schools or were permitted to work. Since 1929, public and parochial school registration has jumped from about 32 percent to 46 percent of children available. Public secondary school registration was equivalent to 33 children per thousand population in 1935.

Children Available, 14-18 Years of Age, 1937 to 1970

On the basis of the predicted birth and death rates, the staff calculated the number of children, 14-18 years of age, that will be available each year up to 1970. Reference to Figure 11 will show that the average death rate, or percent of the age group that died, has fallen from approximately 28 percent in 1920 to 14 percent by 1935. The extension of this curve would continue the obvious trend, reaching 10 in the year 1960 and remaining at this percentage thereafter. Table 16 shows the number of children expected to be available by five year intervals from 1937 to 1971.

Future Secondary School Registration

In Table 15 it was shown that the percent of available children registered in secondary schools has steadily increased. Before estimating future registration, the staff plotted the past percent data for both public and parochial schools and

extended these curves as a continuation of past and current trends. On the basis of these curves, the percent of available children that will register in public and parochial schools was determined for each year up to 1970. The results of this estimate are graphically shown in Figure 11. See also Table 16.

While the number of children available is expected to decline, public school registration is forecast to increase to 65 percent of available children by the year 1962. On this supposition, a maximum registration of more than 302,000 or about 37 children per thousand population would occur in public secondary schools by 1945; but there will be a decline thereafter to about 271,500 or roughly 30 children per thousand population by the year 1970.

REQUIREMENTS FOR ELEMENTARY SCHOOLS

This phase of the Education Study was concerned with the present deficiency and future capacity of the public school plant required to serve the estimated registration. The location, size and type of each public elementary school, as well as attendance figures, were obtained from the Board of Education. Since average daily attendance is reported only by School Districts, these areas necessarily formed the basis for this investigation.

Past Registration by School Districts

The average daily attendance reported for each School District is usually less than the number of children registered. To obtain public school registration it was necessary to adjust attendance figures upward on the basis of ratios given in annual reports of the Board of Education. The

TABLE 15
Children Available, 14-18 Years of Age and Secondary School Registration

School Year	Children Available	Registration		% of Children Registered	
		Public	Parochial	Public	Parochial
1920-21	355,733	72,237	....	20.3	....
1921-22	389,324	86,150	....	22.1	....
1922-23	420,268	97,827	....	23.8	....
1923-24	444,485	103,108	....	23.2	....
1924-25	471,459	113,538	....	24.8	....
1925-26	497,622	124,745	....	25.0	....
1926-27	517,280	131,038	....	25.3	....
1927-28	529,995	138,977	....	26.2	....
1928-29	551,101	149,366	....	27.1	....
1929-30	566,439	159,832	21,003	28.2	3.71
1930-31	572,565	177,531	21,202	31.0	3.70
1931-32	580,699	198,600	21,917	34.2	3.77
1932-33	587,208	218,901	22,852	37.2	3.89
1933-34	581,539	231,582	23,151	39.8	3.98
1934-35	578,826	243,045	23,840	41.9	4.12
1935-36	580,940	243,315	24,493	41.8	4.22

resulting registration figures were then plotted to indicate trends within the district. With only the 1934 population of each district (from the Real Property Inventory) and the estimated ultimate population distribution (from the Mayor's Committee Residential Study) the staff lacked sufficient data on the past to determine current trends of population growth or decline by school districts.

Population of School Districts

Inasmuch as the staff did not have the resources to make careful forecasts of population growth within school districts, it was assumed that the annual rate of growth, or decrease, would be constant for each district. On this supposition the "expected" population was determined from a straight line for each district for the years, 1934 to 1970 inclusive.

The city-wide forecast of public elementary school children registered per thousand population, (Figure 10) could have been used to obtain the probable extent of registration in each district had it not been evident that both the birth and death rates of the several school districts varied from the city-wide average. Therefore the reported birth and death rates by Health Areas, in so far as these Areas correspond with school districts, were compared with city-wide rates to de-

termine the "vital index" of each school district. The "vital index" factor for each school district was then used to adjust the forecast of children registered per thousand population for the entire city; whenever the index was above the city average, the number of children per thousand of the school district's 1970 population were increased in the same ratio that the district's index bore to the city-wide average; when the school district had an index below the city average, then the number of children per thousand of the school district's 1970 population was adjusted down in the same proportion.

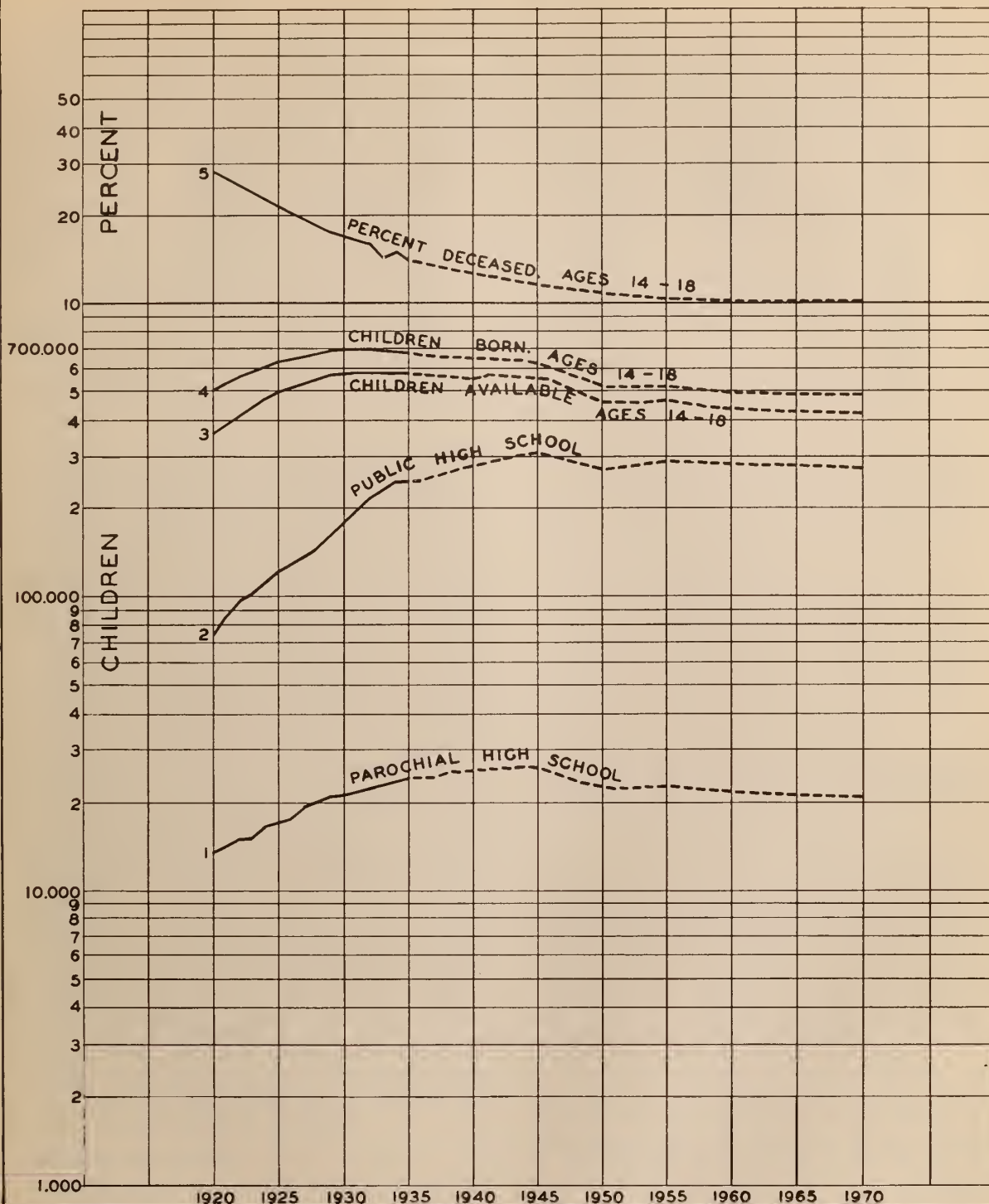
Future Registration by School Districts

The adjusted number of school children registered per thousand of each school district's 1970 population was then plotted, and a straight line drawn from the 1934 number of children per thousand population. This straight line extension was employed to obtain the number of children per thousand population that will probably register for public school in each district for the years 1940, 1945, 1950, 1955, 1960, 1965 and 1970. With the "expected" population and children per thousand figures, the public school registration was calculated for these years.

While it was not possible to include work charts or calculations for each school district in this re-

HIGH SCHOOL DATA...NEW YORK CITY 1920-1970

B5-5



SOURCE OF INFORMATION FROM 1920 TO 1935

1. CATHOLIC SCHOOL BOARD.

2. AVERAGE DAILY REGISTRATION - BOARD OF EDUCATION.

3. 4. 5. BOARD OF HEALTH STATISTICS.

FROM 1936 TO 1970 - ESTIMATED BY M.C.C.P.

MAYORS COMMITTEE ON CITY PLANNING
PROJECT NO. 165-97-6999
(6037-1022) (OLD 319)

MARCH 1937

FIG. II.

TABLE 16
Estimated Children Available for Secondary School and Public and Parochial School Registration

School Year	Children Available	Public Registration		Parochial Registration	
		% of (1)	Number	% of (1)	Number
	(1)	(2)	(3)	(4)	(5)
1937-38	568,371	45.1	256,335	4.33	24,610
1940-41	563,137	49.3	277,627	4.55	25,623
1945-46	547,599	55.2	302,275	4.78	26,175
1950-51	459,320	59.3	272,377	4.88	22,415
1955-56	462,426	62.8	290,400	4.94	22,840
1960-61	433,282	64.8	280,765	4.99	21,620
1965-66	422,785	65.0	274,810	5.00	21,140
1970-71	417,780	65.0	271,557	5.00	20,880

port, the results of this method are illustrated by the figures in Table 17. This table gives the 1934 population, public school registration and registration per thousand population for School District 28 in the Park Slope and Sunset Park sections of Brooklyn. Although not shown in this table, the actual registration in District 28 has declined from 20,400 in 1925 to 19,010 by 1937, according to official reports. Inspection of the table will reveal that the "vital index," given in column headed "f" at 1.179, is higher than the city-wide average and, therefore, the number of children per thousand population for the year 1970 is expected to equal 77 instead of the city average of 70.5 children per thousand population. Hence the number of children registered per thousand population is forecast to decline from 120 in 1934 to 77 by 1970. Further it should be noted that while the total population of the district is expected to increase from about 163,000 to more than 212,000 by 1970, the public school registration would decrease each year from 19,031 in 1936 to 16,332 by 1970.

In the case of District 28, the staff's calculated registration for 1937 was three-tenths of one percent below the reported figure, and for the entire city the estimated registration exceeded that reported by 1.25 percent.

The 1970 registration estimated by school districts, when totaled, equals 650,983 which is about one-quarter of one percent greater than the city-wide estimate previously described.

Existing School Plant

From Board of Education reports the staff determined the number of classrooms in existing public elementary schools, the number of class

rooms in buildings under construction, as well as in schools authorized prior to the 1938 Capital Outlay Budget. In some districts existing buildings include temporary wooden structures and other schools forty years or more of age which were assumed to be obsolete and hence to require replacement by the year 1940.

In each School District "usable" classrooms were ascertained by deducting the number of rooms in obsolete structures from the total classrooms in buildings existing, under construction or authorized prior to the 1938 Capital Outlay Budget.

School Plant Needed by the year 1940

Assuming that buildings under construction or authorized would be ready for occupancy during the school year 1939-40, the staff measured the school needs as of the year 1940.

After consultation with representatives of the Board of Education it was decided that the average size of classes should be taken as 35 students per room; the required number of classrooms in each school district was then determined from estimated registration. When the required number was less than the usable number of classrooms available it was assumed that new construction was not necessary. Whenever the required number was found to exceed usable classrooms it was concluded that new construction was needed.

The results obtained in School District 28, Brooklyn, are again taken as an illustration of this method. The 1940 registration (18,832) divided by 35, indicates that 538 classrooms will be required.

The following tabulation shows that District 28, which includes part of the Park Slope and Sunset Park sections of Brooklyn, will have 372 usable classrooms, and will need 166 additional class-

TABLE 17 Public Elementary and Junior High School Registration School District 28, Brooklyn					
Year	Population	f	Registration		No. Class-rooms
			Per 1000 Pop.	Number	
1934	163,062*	....	120	19,598**	...
1936	165,784	....	115	19,031**	467
1940	171,228	....	110	18,832	538
1945	178,033	....	105	18,690	534
1950	184,838	....	99	18,295	523
1955	191,643	....	94	18,010	515
1960	198,448	....	88	17,468	499
1965	205,253	....	83	17,040	487
1970	212,050	1.179	77	16,332	467
*Real Property Inventory Report			**Board of Education Reports		

rooms in new buildings by the school year 1940-41 to accommodate estimated registration.

Classrooms in existing buildings	467
Under construction or authorized	42
Total available	509
Classrooms in obsolete buildings	137
Usable classrooms.....	372
Additional classrooms required	166
Total needed by 1940....	538

Due to the expected decline in the number of children registered, Table 17 indicates that by 1970 only 467 classrooms will be required in District 28. However, it is not unlikely that some of the buildings now classed as containing usable seats will have become obsolete by 1970, in which case further building will be required to replace some of the obsolete schools that may still be needed at that time. Or on the other hand the locations of some of these usable buildings in relation to population distribution may be such as to render them partially vacant, thus necessitating relocation.

In any event, the 1940 needs are indicated, (in so far as this analysis is valid) but the qualifications are obvious; school location, and the required type and size of building, are factors not considered in this study. It is unfortunate that the lack of time and resources prevented a more detailed study of school needs in close cooperation with the Board of Education. However, this investigation shows clearly that such an exhaustive study can only be undertaken by the Board of Education in consultation with the City Planning

Commission when its master plan studies have reached a sufficiently advanced stage for coordination with school studies.

The results of this investigation are given by School District in Table 18; "M" refers to districts in Manhattan, "B" to Bronx, "K" to Brooklyn, "Q" to Queens, and "R" designates Staten Island Districts. The column headed "Available Rooms" shows the number of classrooms that will be provided by 1940 in existing buildings and schools under construction or authorized in the 1937 Capital Budget. Under the heading of "Obsolete Rooms" the number of classrooms in temporary wooden structures and buildings over 40 years of age are given. The number of usable classrooms in each district, shown as "Usable Rooms", is the balance remaining after subtracting obsolete from available classrooms. The required number of classrooms, given as "Total Needed", is based upon staff estimates of each school district 1940 registration at 35 children per classroom. The column headed "New Rooms Required" indicates the extent of new construction needed by the year 1940.

The sum of the figures in Table 18 indicate that 23,479 classrooms will be available in 1940 of which 5,033 are in obsolete buildings. Reference to Table 18 will reveal that while some districts such as M-14 and B-19, have no obsolete buildings, registration in certain other districts, M-1 and M-4 for example, will not require the replacement of obsolete schools in these and other areas. In districts like M-5 only a portion of the obsolete rooms need be replaced, but in such districts as B-16 and Q-45 all of the obsolete rooms should be replaced and additional new rooms pro-

MAYOR'S COMMITTEE ON CITY PLANNING THE CITY OF NEW YORK

FIORIELLO H. LA GUARDIA
MAYOR



TIMOTHY J. SULLIVAN
CHAIRMAN

PRELIMINARY CONCLUSION AS TO ELEMENTARY AND
JUNIOR HIGH SCHOOL NEEDS FOR ESTIMATED POPULATION
OF 1970 DETERMINED ON THE BASIS OF CLASS ROOMS
REQUIRED FOR EACH SCHOOL DISTRICT BY THE STAFF OF THE
MAYOR'S COMMITTEE ON CITY PLANNING.

LEGEND

TOTAL ESTIMATED CLASS ROOMS REQUIRED 1970



NUMBER OF CLASSROOMS EXISTING, INCLUDING
THOSE UNDER CONSTRUCTION AND THOSE IN
1937-38 BUDGETS. CLASSROOMS 40 YEARS OF
AGE OR MORE SHOWN BY HATCHED PORTION



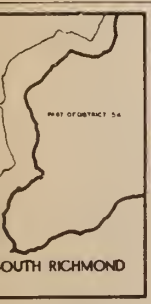
ADDITIONAL CLASSROOMS NEEDED IN NEW
SCHOOLS PLUS OBSOLETE CLASSROOMS THAT
SHOULD BE REPLACED PRIOR TO 1970



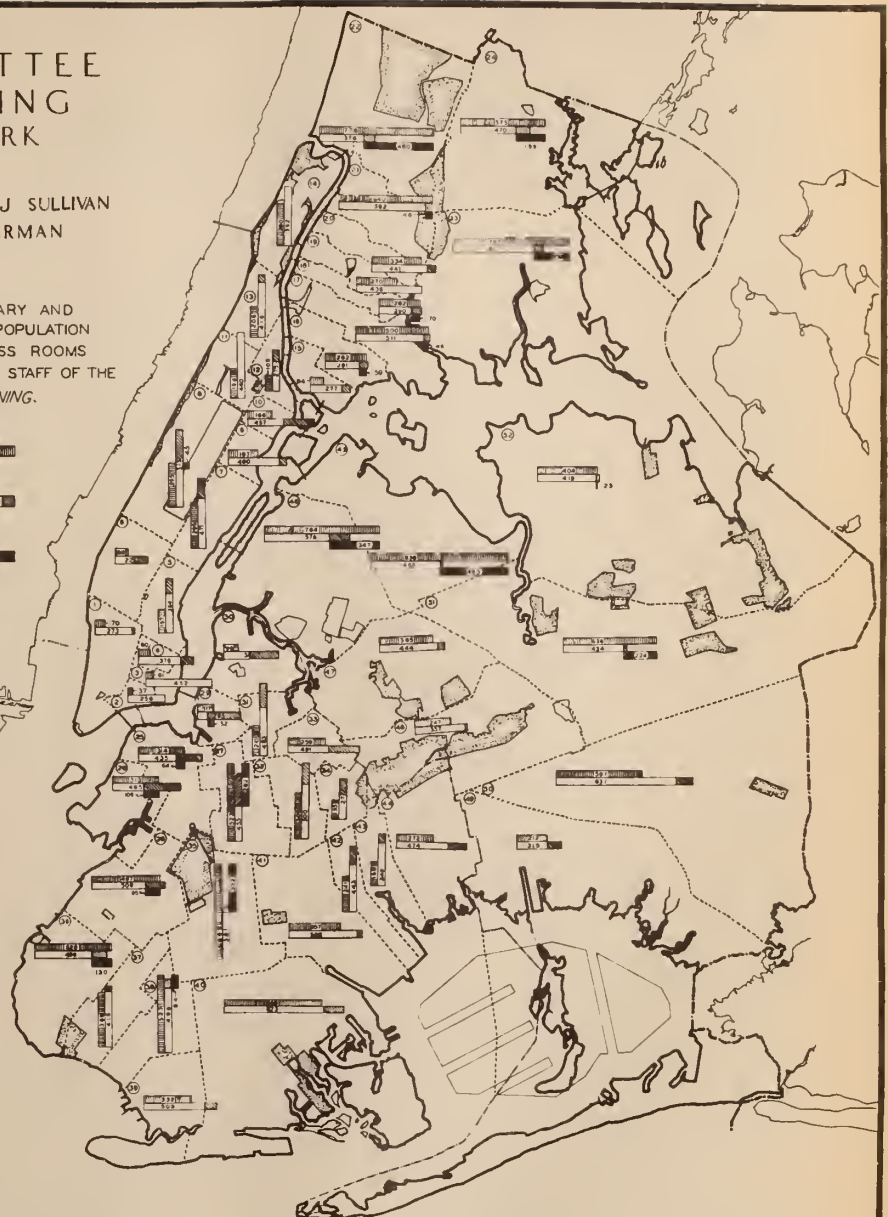
CLASS ROOM SCALE
0 50 100 200

ONE MILE IN 1970

JANUARY 1936



SOUTH RICHMOND



NOTE -
SCHOOL DISTRICT NUMBERS SHOWN THUS - ①

FIGURE 12

NOTE FOR SOUTH RICHMOND
SEE INSERT ABOVE

vided in new schools as well as to take care of the anticipated registration. ⁽¹¹⁾

In order to meet the indicated requirements in each district for public elementary school registration 5,027 additional classrooms will be needed by 1940 for both new schools and replacements. On the basis of current conditions, the average cost per classroom for land and construction was assumed at \$21,000 which would bring the total cost of these additional schools to \$105,567,000.

REQUIREMENTS FOR PUBLIC SECONDARY SCHOOLS

New York City high schools provide both general academic and specialized vocational training to meet the individual needs of students. In secondary schools the restrictions on attendance in respect to place of residence are more flexible than in elementary schools. Therefore the secondary school study was made on the basis of borough needs as indicated by the estimated high school registration.

TABLE 18
Estimate of New Classrooms Required for Public Elementary Schools
In Each School District by the Year 1940

School Dist.	Available Rooms	Obsolete Rooms	Usable Rooms	Total Needed	New Rooms Required	School District	Available Rooms	Obsolete Rooms	Usable Rooms	Total Needed	New Rooms Required
M-1	273	20	253	199	0	K-28	509	137	372	538	166
M-2	256	0	256	165	0	K-29	295	230	65	296	231
M-3	452	0	452	311	0	K-30	381	199	182	130	0
M-4	376	89	287	278	0	K-31	483	159	324	373	49
M-5	364	102	262	281	19	K-32	500	147	353	515	162
M-6	226	102	124	183	59	K-33	491	211	280	457	177
M-7	471	134	337	375	38	K-34	277	116	161	241	80
M-8	515	265	250	465	215	K-35	381	40	341	494	153
M-9	400	44	356	376	20	K-36	496	100	396	655	259
M-10	457	210	247	438	191	K-37	416	36	380	541	161
M-11	440	0	440	482	42	K-38	498	59	339	580	141
M-12	275	82	193	241	48	K-39	503	93	410	491	81
M-13	416	49	367	406	39	K-40	823	152	671	669	0
M-14	392	0	392	406	14	K-41	502	38	464	605	141
B-15	277	63	214	204	0	K-42	443	121	322	385	63
B-16	291	68	223	398	175	K-43	349	67	282	370	88
B-17	511	57	454	578	124	K-44	474	125	349	438	89
B-18	290	78	212	377	165	Q-45	488	15	473	610	137
B-19	436	0	436	502	66	Q-46	578	141	437	601	164
B-20	441	54	387	475	88	Q-47	444	28	416	409	0
B-21	592	0	592	669	77	Q-48	357	19	336	324	0
B-22	378	80	298	419	121	Q-49	315	103	212	279	67
B-23	615	61	554	627	73	Q-50	937	118	819	894	75
B-24	470	94	376	516	140	Q-51	434	22	412	442	30
K-25	435	185	250	374	124	Q-52	419	38	381	377	0
K-26	465	258	207	454	247	R-53	372	90	282	351	69
K-27	455	214	241	541	300	R-54	345	120	225	284	59

(11) Table 14 and Figure 10 show the total city-wide elementary school registration forecast for each year up to 1970. Figure 12 shows the number of classrooms required to meet the registration anticipated in each school district for the year 1970. This graphic map is of interest here because, when compared with the figures in Table 18, it indicates the probable trends of registration in the public schools of each district between 1940 and 1970, and thereby suggests the problems that will be raised by a declining register in connection with the replacement and relocation of "obsolete" schools. Reference to Figure 12 will reveal that the set of bars in each school district are drawn to the same scale, and that the length of the top bar in-

dicates the number of classrooms required in 1970; the length of the second bar shows the number of classrooms in existing schools, buildings under construction or authorized in the 1937 Capital Outlay Budget, but the cross hatched portion of this bar reveals the number of classrooms in obsolete schools; and the solid bar shows the number of additional classrooms needed in new schools including that portion of classrooms in obsolete buildings that should be replaced prior to 1970. This map also shows by a broken line the boundaries of school districts and the numerals used by the Board of Education to designate each district.

TABLE 19
Estimated High School Seats Needed by the Year 1945

Borough	Registration	Needed Seats	Available Seats	Seats in Obsolete Buildings	Usable Seats	New Seats Needed
Manhattan	63,185	69,504	54,617	7,196	47,421	22,083
Bronx	62,963	69,259	40,680	1,207	39,473	29,786
Brooklyn	110,481	121,529	84,279	5,402	78,877	42,652
Queens	56,977	62,675	46,056	1,834	44,222	18,453
Richmond	8,646	9,511	6,759	....	6,759	2,752
Totals	302,252	332,478	232,391	15,639	216,752	115,726

Table 16 and Figure 11 show that the largest registration is expected in the year 1945, and that thereafter, with fewer children available, the registration will decline.

The staff selected the year of the largest indicated registration in high schools as a basis for measuring plant requirements; first, because it was assumed that schools authorized or under construction will be opened by 1945, and secondly, if the greatest physical needs are met during the next eighteen years, it might be possible during the following years of declining registration to abandon such structures as will have become obsolete, in addition to those buildings considered obsolete in this study.

Present High School Plant

From official reports the staff obtained the number of seats in existing high schools, buildings under construction, and schools authorized prior to the 1938 Capital Budget. Due to the specialized type of instruction and the rapid changes in secondary school teaching methods the size of classes is apt to vary considerably from year to year and from school to school. Hence the staff believed that seats, rather than classrooms, would furnish a reliable norm for determining needs. Available data indicate that there is an average of 1.1 seats per child registered in high schools.

Future High School Needs

The expected 1945 high school registration would be equivalent to 36.95 pupils per thousand of the estimated population for the city. This figure was not adjusted according to variations of the borough vital index from the city average for births and deaths. Accordingly the registration figures in Table 19 are based upon 36.95 children per thousand of the population expected in each borough, and "Needed Seats" are 1.1 times registration. The number of seats in existing schools,

buildings under construction and authorized prior to the 1938 Capital Budget is given under "Available Seats"; the seats in schools that are forty years or more of age, assumed to be obsolete and to require replacement, as shown in the table under "Seats in Obsolete Buildings". Under "Usable Seats" are shown the number of seats that would be available if the obsolete buildings were demolished; the additional seats necessary to meet the resulting deficiencies are given under "New Seats Needed".

On this basis 115,726 new seats would be needed by the year 1945, which at an assumed average cost of \$1,200 each for land and construction would require expenditures totaling \$138,871,200.

COLLEGE FACILITIES

The Board of Higher Education conducts four publicly supported colleges in New York City: City College, Brooklyn College, Hunter College, and Queens College. City College is located at 139th Street and Convent Avenue with a School of Business and Civic Administration at Lexington Avenue and 23rd Street, Manhattan; Brooklyn College, which was opened in 1930, is concentrated at Bedford and Avenue H in Brooklyn; Hunter College has several locations including 2 Park Avenue, Lexington Avenue at 68th Street, 145 East 32nd Street, two High School Annexes on East 32nd and 96th Streets in Manhattan, as well as a new campus on Bedford Park Boulevard in The Bronx; Queens College, 65-30 Kissena Boulevard, Flushing, was opened in the Fall of 1937.

While each of these institutions offer college courses in regular day classes to citizens of New York City, City College and Hunter also conduct evening sessions. The registration figures, Table 20, are one indication of the importance of this municipal collegiate system. From about 11,500 in 1927 the number of day students has steadily

TABLE 20
Spring Registration in New York City Colleges
(Based on Information from the Registrar's Offices)

Year	Hunter	Brooklyn	City	Queens	Total Day	Evening Sessions
1927	3,637	(¹)	7,871	(²)	11,508	11,422
1928	4,603	(¹)	8,374	(²)	12,977	18,136
1929	5,331	(¹)	10,798	(²)	16,129	19,257
1930	5,614	5,323	10,422	(²)	16,359	26,572
1931	4,663	4,612	10,746	(²)	19,921	23,937
1932	4,652	4,321	10,222	(²)	19,195	23,520
1933	5,780	4,368	10,306	(²)	20,454	24,546
1934	5,874	4,526	10,481	(²)	20,881	24,041
1935	6,507	4,704	11,353	(²)	22,564	24,912
1936	6,731	5,096	10,957	(²)	22,784	25,134
1937	6,943	5,579	10,741	*400	23,653	25,248
1938	7,068	5,841	11,164	\$806	24,889	23,831

(¹) Brooklyn branch of Hunter College became Brooklyn College in 1930

(²) Queens College opened in the Fall of 1937

* Fall 1937 } Freshman classes only
\$ Spring 1938 }

increased to more than 24,000 by 1938, and the number of students registered for the evening sessions has also more than doubled during this period. Budget appropriations for operating expenses under the Board of Higher Education, a further indication of the rapid growth of city colleges, increased from 26c. per capita in 1920 to \$1.24 per capita by 1938. The recent opening of Queens College and the expansion of Hunter College evidence the definite trend toward the provision of additional facilities for college training at public expense.

Future College Plant

While the tendency is clear, and growth may reasonably be expected to continue in the future, the Mayor's Committee staff lacked the resources necessary to evaluate the adequacy of present college facilities and to determine future physical needs. While it is possible to forecast future college registration on the basis of current trends, it would be difficult to measure the resulting requirements since the reorganization of curricula, the consolidation or extension of graduate and undergraduate educational programs, as well as other determining factors, are subject to changes of policy or progress in educational methods.

Therefore, the staff employed past capital outlays as an indication of future expenditures that may be required for city colleges. Total outlays for the municipal colleges, Table 21, exceeded 13.5

million dollars (exclusive of PWA or WPA funds) for the period 1927-36; an average of 1.04 million per year. Per capita expenditures for permanent college improvements varied from 2 mills in 1927 to 52c. in 1936, but averaged 19c. annually. Assuming that this past per capita average would represent a reasonable allowance for future expenditures, the staff estimated that 9 million dollars would be required during the six years 1939-44, about 9.5 million for the succeeding six years, and 10 million dollars for the six years 1951-56, a total of 28.5 million dollars for eighteen years.

This estimate is believed sufficient to include the new building being erected for Hunter College at Park Avenue and 68th Street, and to allow for normal extension and improvements to city colleges.

INDICATED CAPITAL EXPENDITURES

A summary of the estimated cost of educational facilities revealed as desirable by these analyses is given in Table 22, according to the three 6-year capital budget periods employed in the Mayor's Committee studies. If elementary schools considered obsolete are replaced, and new buildings erected to take care of the 1940-41 registration, the city is faced with expenditures of more than 100 million dollars. On this basis heavy expenditures for elementary schools would be made within the first 6-year period, but no outlays are indicated

TABLE 21
Capital Outlays under the Board of Higher Education from City Funds
(Information from Comptroller's Report)

Year	Total in Millions	Dollars Per Capita	Year	Total in Millions	Dollars Per Capita
1927	0.013	0.002	1932	1.251	0.18
1928	0.948	0.14	1933	0.202	0.03
1929	0.740	0.11	1934	0.016	0.002
1930	2.517	0.36	1935	1.746	0.24
1931	2.201	0.31	1936	3.882	0.52

by this study for the second and third 6-year periods.

In the case of secondary schools the city would have to expend nearly 140 million dollars in seven years to provide an up-to-date high school plant to serve the 1945-46 registration. But this analysis does not indicate the need for any additional outlays thereafter.

Along with outlays for college plant indicated expenditures total 233.6 million for the first, 29.33 million for the second, and only 10 million dollars for the third 6-year period, or approximately 273 million dollars during the eighteen years. However, such a program is not realistic — it does not provide for balances of authorizations remaining from prior capital budgets required to complete schools under construction, nor for the replacement or relocation of elementary and secondary schools, that in addition to buildings included in this study will become obsolete within the next eighteen years.

Such needs must be considered and the total estimated costs related in order of urgency to the city's requirements for, and its ability to finance, other permanent improvements. Even if the necessary funds should be available it is unlikely that sites could be designated and purchased, plans and specifications drawn, and contracts let for so large a school building program in so short a time.

Relation To Capital Outlay Program

When the above schedule of expenditures is related to the city's financial resources, and to expenditures for other desirable permanent improvements, it becomes obvious that if the city's most urgent needs are to be met no such extensive outlays for schools are possible during the first 6-year period. The Mayor's Committee studies reveal that certain types of improvements such as water supply cannot be postponed, and that the need

for other facilities are equal in importance to schools. Consequently, the school program must proceed at a reduced rate; many of the buildings considered obsolete must remain in service longer than anticipated in this study in order to provide facilities in quantity sufficient to meet the requirements of the expected registration.

SUGGESTED CAPITAL PROGRAM

It would have been desirable to estimate elementary and secondary school registration for each year as a measure of needed plant and to allow for replacement of specific obsolete buildings to the full extent of available funds. It was not possible, however, to extend the investigations on this basis. Therefore, it was assumed that the provision of new facilities required on the basis of this study should be given priority and that replacement and relocation of obsolete schools should follow as rapidly as funds permit.

New Elementary Schools

Although no obsolete buildings are replaced, additional rooms will be required in some districts to provide for the 1940 elementary registration forecast by school districts. Table 23 shows the number of new classrooms required by 1940 if all replacements were postponed.

For the entire city it appears that a total of 1,423 new classrooms will be needed, which at an assumed cost of \$21,000 each for land and construction will require outlays of 31.08 million dollars during 1939 and 1940.

New Secondary Schools

Since high school registration was forecast to reach a peak during the year 1945, the provision of new facilities required to meet anticipated needs is more urgent than the replacement of obsolete buildings. Table 24 indicates the num-

TABLE 22
Indicated Capital Expenditures
(Figures in Millions of Dollars)

Purpose	1939-44	1945-50	1951-56	Total
Elementary	105.56	.....	....	105.56
Secondary	119.04	19.83	....	138.87
College	9.00	9.50	10.00	28.50
Total	233.60	29.33	10.00	272.93

ber of seats needed by 1945 in new secondary schools provided that all buildings considered obsolete are kept in service.

On this basis a total of 100,087 new seats would be required by 1945, which at \$1,200 each for land and buildings would cost \$120,104,400. It was assumed that the actual outlays could be spread over the seven years 1939-45 to obtain the plant required by the school year 1945-46.

Additional Appropriations Required

In the Finance Study it was assumed that outlays authorized for expenditures during the twelve months covered by the 1937 Capital Outlay Budget would become actual appropriations of funds that would be expended during that period, and that any balance required to complete authorized projects after 1937 would be included in the 1938 or subsequent Capital Budgets. An examination of budget authorizations indicates that 32.21 million dollars would be needed on this basis to complete elementary and secondary schools already under construction or authorized.

The above balance of authorizations was included in the first six-year period, rather than assume that they could be taken care of during 1938 with the relatively small amounts available for capital expenditure in the last nine months of 1938.

Replacements and Relocations

Inasmuch as the staff could not undertake the detailed investigations that would indicate speci-

fically the new schools needed and the obsolete buildings that should be replaced and relocated during each of the three 6-year periods, the use of a depreciation factor offered the means for estimating the extent of such needs. While this method does not consider all the factors affecting new buildings, nor the obsolescence or relocation of structures within each school district, it does indicate the probable extent of outlays that will be needed to keep the school plant up-to-date.

The 1936 Annual Financial and Statistical Report of the Board of Education shows the total accumulated cost of the elementary and secondary school plant as 503.2 million dollars on December 31, 1936. This figure represents the net investment in existing buildings and land, but an analysis of this report reveals that buildings averaged 81 percent of the total investment during the years 1912-36 inclusive. In this study it was assumed that land does not depreciate and that fifty years represents the average useful life of school buildings. The annual allowance for new schools and replacement of obsolete schools was then calculated at 2 percent of the estimated net investment in buildings during each of the three 6-year periods.

For the first 6-year period—In order to obtain the building investment the staff included additional appropriations required to complete schools under construction or authorized in the 1937 Capital Budget, as well as the amounts assumed to have been spent during 1938. On this basis the total cost of school plant would be 559.7 million dollars, as shown in the following tabulation:

Accumulated Cost of School Plant in Millions of Dollars

Investment as of December 31st, 1936.....	503.2
Additional Appropriations Required to complete schools authorized in 1938 Capital Outlay Budget	32.2
1937 Capital Outlay Budget Authorizations	<u>24.3</u>
Total Cost of Plant	559.7

TABLE 23
School Districts in which New Classrooms will be needed by 1940 for
Expected Registration in Elementary Schools

School Dist.	Available	Require	New	School Dist.	Available	Require	New
* M-11	440	482	42	K-29	295	296	1
M-14	392	406	14	K-32	500	515	15
** B-16	291	398	107	K-35	381	494	113
B-18	290	377	87	K-36	496	655	159
B-19	436	502	66	K-37	416	541	125
B-20	441	475	34	K-38	498	580	92
B-21	592	669	77	K-41	502	605	103
B-22	378	419	41	K-43	349	370	21
B-23	615	627	12	§ Q-45	488	610	122
B-24	470	516	46	Q-46	578	601	23
***K-27	455	541	86	Q-51	438	442	8
K-28	509	538	29	Total New Classrooms.....1423			
* M-Manhattan; ** B-Bronx; *** K-Brooklyn; § Q-Queens							

Employing the past average ratio of building cost to land cost, the net investment in buildings was estimated as 81 percent of total cost of plant, or 453.3 million dollars. On this basis the 2 percent allowance for depreciation would approximate 9 million dollars per year, and total 54 million dollars for the six years 1939-44.

For the second 6-year period—The cost of new elementary and secondary schools recommended in this section for construction during the first 6-year period aggregates 134.08 million dollars. Assuming that building costs will average 81 percent, the additional investment in construction would be about 108 million dollars which would bring the total building cost to some 560 million by 1944. During the six years, 1945-50, the allowance for depreciation on the accumulated investment would then be about 11 million per year or 66 million dollars for the period.

For the third 6-year period—The cost of secondary schools recommended for construction during the second 6-year period would bring the total building investment to approximately 575 million dollars by 1951. On this figure the depreciation allowance would average 11.5 million dollars per year and total 69 million dollars during the six years, 1951-56.

The designation of buildings that should be relocated or replaced by new schools would involve detailed investigations which were beyond the province of this study. It is believed that the above allowances for obsolescence, however, would go a long way toward bringing the school plant up-to-date during the next eighteen years.

Eighteen-Year Capital Program

The suggested program for capital expenditures, indicated as necessary by these analyses is summarized in Table 25 according to the three 6-year periods. New elementary schools costing 31.08 million, and new secondary schools estimated at 120.01 million dollars should be provided during the eighteen years, 1939-56. In addition 32.21 million dollars will be required to complete both elementary and secondary schools under construction; 189 million for additional new schools and replacement or relocation of obsolete structures; and 28.5 million dollars for colleges. Since expenditures for college improvements were based upon past per capita figures, they are assumed to allow for depreciation as well as for normal extensions.

Although this program aggregates more than 400 million dollars, suggested expenditures would decline from nearly 230 million dollars for the first 6-year period, to 92.6 million the second, and to 79 million dollars during the third period. In view of the decreasing registration, already evident in elementary schools and expected in secondary schools after 1945, the continued expenditure of large sums to expand school facilities thereafter will no longer be required. The needs of the future can apparently be met by smaller outlays for carefully located new schools that will be needed as a result of developments in areas now sparsely settled, and for the relocation or replacement of obsolete buildings in built-up sections of the city.

TABLE 24
New Seats Needed by 1945 for Expected Peak Registration in Secondary Schools

Borough	Available Seats	Required Seats	Additional Seats Needed	Estimated Cost
Manhattan	54,617	69,504	14,887	17,864,400
Bronx	40,680	69,259	28,579	34,294,800
Brooklyn	84,279	121,529	37,250	44,700,000
Queens	46,056	62,675	16,619	19,942,800
Richmond	6,759	9,511	2,752	3,302,400

TABLE 25
Suggested Capital Program for Education
(Figures in Millions of Dollars)

Period	1939-44	1945-50	1951-56	18-Year Total
Elementary—New	31.08	....	....	31.08
Secondary—New	103.00	17.10	....	120.10
Replacements	54.00	66.00	69.00	189.00
Under Construction	32.21	....	....	32.21
College	9.00	9.50	10.00	28.50
Total	229.29	92.60	79.00	400.89

The Park System

INTRODUCTION

The acquisition and development of parks has gone forward so rapidly during the past five years, and is proceeding so rapidly, that any report of status must of necessity be a report of progress, soon to become obsolete by further advances. However, despite the remarkable improvements in the park system that have been made under the leadership of Commissioner Robert Moses, there is still a great deal that remains to be done before the city has adequate park facilities for all of its people.

As with other types of public work, the goal cannot be reached other than by a long, slow process, as the city's needs are greater than its financial capacity. Available resources must provide schools, sewers, streets and transit as well as parks, and no single need can be completely satisfied at the expense of neglecting others equally important. The solution of the park and recreation problem must form part of a rational Master Plan, supported by a long range financial program that is both realistic and practical. The recommendations in this report have therefore been expressed not only in acres, but in dollars and cents of funds that are estimated to be available over the years, as determined after study of the relative needs for other improvements that must have an equal place in the Master Plan.⁽¹²⁾

Types of Park and Playground

The park system may be conveniently classified under four headings, each corresponding to a separate functional use:

Playgrounds are essentially small areas for active recreation. They serve primarily the very young elements of our population. Although both large and small parks frequently include playgrounds, many more are needed than can be provided in existing parks or parks that can reasonably be contemplated as future acquisitions. Playgrounds can be small, an area of 2.5 acres being sufficient for a wide range of equipment. In heavily populated areas, larger size — up to about 5 acres — is desirable. However, even an acre of ground is better than nothing, and much good can be done by clearing a small group of lots in a city block for playground use, when more ample space can-

not be obtained. The deficiency of playgrounds has been recognized by the Park Department, and notable progress is being made to provide more adequately for this form of recreation. It is now also recognized that the public schools should have extensive playground area adjacent to them. Unfortunately, a large proportion of the New York schools were built on small sites before the importance of outdoor play space was recognized as an essential part of the educational plant. In most cases it is too late to remedy the lack of school playgrounds, and provision must therefore be made on other locations.

Athletic Fields provide space for large scale active recreation, including football, track, baseball, swimming and other sports that attract the adolescent and young adult population. It is usual to find athletic fields in the larger parks, when the ground is sufficiently level. Similarly the newer high schools provide excellent space for athletics. Where there is no large park nearby, and no modern high school, there is generally no public athletic field. The minimum adequate area to provide a football field and track is 5.5 acres. In areas already built nearly solid with apartment houses and homes, it is extremely difficult to correct the lack of athletic field space, because the area requirements and resulting costs are so large.

Small Parks supply space for quiet relaxation and thus appeal especially to the older age groups, and to mothers with babies. In many cases they include playgrounds for young children and some provision for outdoor games. But these are separate from their basic purpose of providing breathing space, green grass and trees, where people may sit and rest if they will, and enjoy themselves in quiet surroundings. New York does not have nearly enough of these little parks; and unfortunately it is difficult to provide them in neighborhoods that are already built up. There is no "minimum area" for a small park, but to achieve a suitable degree of amenity, an area of 2.5 acres or more should be provided if possible.

Large Parks, such as Van Cortlandt, Forest and Prospect, serve not merely their local neighborhoods but whole sections of the city. Besides the usual facilities of formal playgrounds and athletic fields, the large park offers a variety of special advantages, such as hiking, boating, surf bathing, skating, picnic grounds, bridle paths, golf and other country and holiday pursuits. They attract

(12) The original report on the Park Study was completed in October, 1938.

people for all day excursions and provide a degree of *rus in urbe* that is most important as a balance wheel in the fast moving mechanical clockwork of city life. New York is now reasonably well provided with large parks. The most notable opportunities for acquiring additions occur in The Bronx, Richmond and Queens, including certain islands in the Jamaica Bay area.

Cost of Recommended Program

This report attempts to present not only an analysis of existing park and recreational space based on the most recent available figures, but also an evaluation of the future needs of every section of the city. These needs have been gathered together into a comprehensive program that is recommended as practical for the city to carry out over the next 32 years.

EXISTING PARK SYSTEM

Referring to Table 26, it will be noted that there were 18,835 acres of publicly owned land under the jurisdiction of the Department of Parks, as of January 1, 1938. Since that time there have been further acquisitions. The proportion of each borough devoted to parks is also given in Table 26, and is expressed visually in the circular diagrams shown in Figure 13. For the entire city, 9.5 percent of the area represents parks. As high a proportion as this must be considered good, and would be so considered in most cities of large size. New York's deficiencies are not so much in the *area* of park property as in its *unequal distribution*, resulting in large sections being virtually without park facilities.

The Borough of The Bronx, with its three large parks (Van Cortlandt, Pelham and Bronx), has

TABLE 26
Park Areas Existing January 1, 1938 as Related to Population and Borough Area

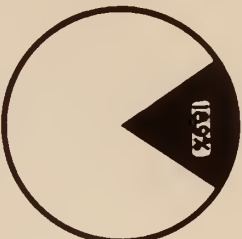
Borough	Borough Area	Population (1934)	*Park Area Jan. 1938	Park Area per 100,000 population	% of Area in Parks
Manhattan	14,211	1,724,245	2,520	146	17.7
Bronx	27,351	1,294,873	5,159	400	18.9
Brooklyn	47,660	2,550,448	3,786	149	8.0
Queens	70,370	1,144,250	4,589	400	6.5
Richmond	38,738	160,338	2,781	1,735	7.2
New York City	198,330	6,874,154	18,835	274	9.5
*Includes large parks, small parks, parkways, playgrounds and athletic fields (acreage supplied by Department of Parks).					

The program of additional area requirements adds up to 2,635 acres for playgrounds, athletic fields and small parks, which the staff estimates can be provided at a cost of about \$360,000,000 including the expense of development and equipment. Consideration should also be given to the proposals for large parks worked out by the Regional Plan Association. These recommendations involve 5,204 acres, excluding parkways primarily for automobile traffic. The Mayor's Committee staff prepared estimates indicating that the cost of this large park program would approximate \$60,000,000. After allowing for depreciation and replacement during the 32-year period, the aggregate outlay for all types of park work (other than current maintenance and operation) would be \$485,654,000.

5,159 acres of park land, or nearly 19 percent of its total area. At the opposite end of the scale we have Queens with only 6.5 percent in parks, although this actually represents a large acreage of parks, due to the great expanse of the borough. Notable among the Queens parks are Forest, Kissena, Alley Park and the site of the World's Fair, which will subsequently become a permanent public park.

Manhattan, the most densely populated of the boroughs nevertheless has room for 2,520 acres of park which represents 17.7 percent of the area of the Island. Of this, Central Park accounts for 840 acres. Other large parks are Fort Washington, High Bridge, Inwood Hill, and Riverside. All of these are over 100 acres in extent, but their narrow shape and difficult topography limit their usability for active recreation. Included in

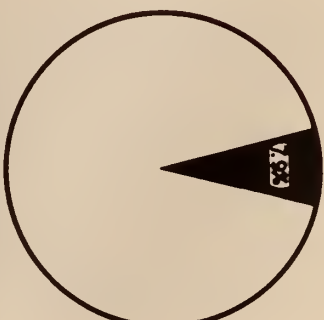
PARK AREAS IN NEW YORK CITY



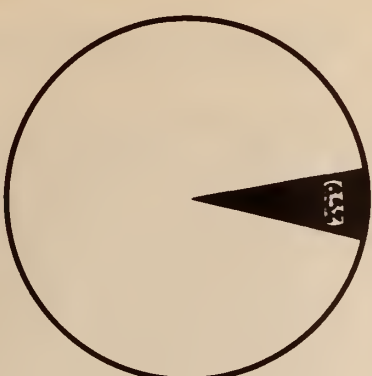
BRONX
TOTAL 27,351 ACRES



MANHATTAN
TOTAL 14,211 ACRES



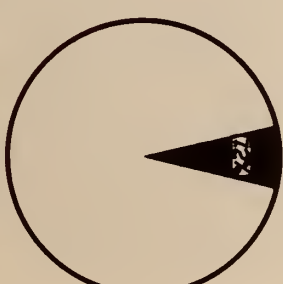
BROOKLYN
TOTAL 47,060 ACRES



QUEENS
TOTAL 70,370 ACRES



GREATER NEW YORK
TOTAL 190,330 ACRES



RICHMOND
TOTAL 38,738 ACRES

DISTRIBUTION OF PARK ACREAGE AS DETERMINED BY
MAYOR'S COMMITTEE ON CITY PLANNING
BASED ON DATA FROM NYC. DEPARTMENT OF PARKS
JAN. 1, 1938.

Manhattan's total are Randall's Island and Ward's Island, which together comprise approximately 430 acres.

Table 26 indicates a very wide borough variation in the area of parks per 100,000 population, ranging from 146 acres in Manhattan all the way to 1,735 acres in Richmond. It is interesting to note that The Bronx and Queens differ little in population and total acres of park, and thus show the same park area per 100,000 population; yet Queens with nearly three times as great an expanse has only a little better than a third as large a proportion of the borough area devoted to parks. The New York City average is 274 acres of park per 100,000 people, which compares not unfavorably with statistics for other large American cities.

STANDARDS FOR PARK ADEQUACY

In order to judge the sufficiency of the existing park system, and to be able to measure future needs for more park, playground and athletic space, it is essential to develop a rational set of standards that can be used as a yardstick. The basic elements or variables to be taken into account are as follows:

- Type of park or playground
- Area of park or playground
- Present population to be served
- Ultimate population to be served
- Contributory area to be served

The staff of the Planning Committee made an extensive study of standards and criteria developed by the National Recreation Association, the Russell Sage Foundation and the Regional Plan Association. Separate standards evidently apply to the four different classifications of park property described in the introductory section of this report. It was found that basic criteria as to number of square feet of area required per person for different types of park had to be translated into terms of population and area to be served. This involved the derivation of empirical formulae corresponding to different conditions. The following fundamental standards were adopted as the basis for all calculations:

Playgrounds: to serve the age group from 5 to 15 years, with 25 percent of this group to be accommodated at one time, and 70 sq. ft. of space per person actually on the playground.

Athletic Fields: to serve the age group from 12 to 24 years with 5 percent of this group using the field at one time. In this case the actual area required per person was taken as 1,000 sq. ft., because activities such as baseball, football,

and track require a large area for very few participants.

Small Parks: to serve all ages of the population on the basis of not more than 4 percent of the contributory population desiring to use the park at one time; with an allowance of 250 sq. ft. of area for each person in the park.

Using the above figures it was possible to compute the area required per 1,000 people for a park including playground, athletic field, and quiet space. The resulting figure was 0.57 acres per thousand aggregate population of all ages, which may be otherwise expressed as one acre per 1,750 people.

A park combining these three types of facility would require a minimum area of ten acres, consisting of 5.5 acres for the athletic field and the balance about equally divided between playground for young children and quiet space primarily for adults. Actually it would be preferable for a composite park to have an area of at least 12.5 acres, so as to give a playground of 4.5 acres, which is a desirable size in apartment house neighborhoods. However, the lower figure of 10 acres was used as a criterion of adequacy, so that this study might be thoroughly realistic in its approach to the problem.

Quiet parks should be spaced not more than three-quarters of a mile apart so as to be easily reached by all residents of the neighborhood. This same spacing was assumed as proper for children's playgrounds. In the case of athletic fields, a spacing of one and one-half miles is satisfactory in single family neighborhoods; but for more densely built areas the distance apart should be materially reduced when possible. In an apartment district with a population of 175 persons per acre, it was found that athletic fields of 5.5 acres each should have a theoretical spacing of one-half mile (10 short blocks). This spacing can rarely be attained; and when the population density exceeds 175 per acre it becomes virtually impossible to correct a serious deficiency of athletic fields.

In the case of existing small parks under 10 acres in area, it was assumed that they do not and cannot provide athletic space as distinct from playground area for young children. They were therefore treated as a special case, using a different formula for determining the area and population that they should serve.

The above described standards are believed to represent conservative good practice, without erring too far either toward ideal conditions, or gross short-sightedness and insufficiency. The standards finally settled on by the staff are ad-

mittedly not without limitations. By and large, however, they are believed to furnish a rational basis for measuring existing park adequacy and for determining the extent of additional park area that should be acquired.

After some consideration, it was decided that the problems of large park sufficiency and future need cannot satisfactorily be reduced to mathematical terms, as types of facilities vary so widely; and the location and availability of land inevitably plays a deciding factor in determining the advantages of a particular site.

ADEQUACY OF EXISTING PARK SYSTEM

Having determined a satisfactory method for use in analyzing the sufficiency of present parks, playgrounds and athletic fields, the staff proceeded to apply it to actual conditions in all sections of the city. The Real Property Inventory of 1934 was used to determine the population of each of 725 residential areas. Appropriate groupings of these areas were made in order to obtain neighborhoods contributory to each existing park (see Figure 14). Using the known area of the park, or playground, the population that it is capable of serving was computed. With this population established, and the density of the surrounding area also a known factor, it was merely a matter of division to determine the number of acres in the area contributory to the park. The boundaries of this contributory area were then plotted on the map, Figure 14, in such a way as to give reasonably constant distance from the park to the periphery of the area, care being taken to follow the center lines of existing streets. Where two parks were close together, the boundaries of their contributory areas were generally fixed half-way between them.

In the case of parks exceeding 50 acres, the area of influence was assumed not to extend further than 2,000 feet from the edge of the park (three-eighths of a mile). This is deemed to be an appropriate maximum distance that people should be expected to walk.

Referring to Figure 14, the smallness of the shaded areas that are served by parks and the almost universal expanse of unserved areas together present a vivid picture of the critical nature of the park problem. Outside of Manhattan and western Bronx, there are few sections where the areas of influence of adjoining parks do not leave "parkless" area between them. And in much of Brooklyn and Queens, the unserved territory is many times the extent of that which now is accessible to existing parks.

FUTURE REQUIREMENTS

After completing the analysis of existing facilities, the staff proceeded to study the extent to which these facilities can be relied upon to serve the ultimate population; and to indicate additional areas for small parks, playgrounds and athletic fields that will be needed in neighborhoods not now served, and where the existing facilities are insufficient. The same methods were used as for the analysis of the present park pattern, and again the need for large wild parks was not included in this part of the study. Staff estimates for the ultimate population of residential areas were relied upon as an appropriate guide to the future geographical distribution of growth.

Figure 15 shows existing parks and their areas of influence. The size of the area that each park will serve was computed from the estimated ultimate population of the local neighborhood. Referring again to Figure 15, the areas enclosed by broken lines are predominantly non-residential districts. Light solid lines indicate the boundaries of statistical areas used for the purpose of analyzing and tabulating population statistics and park needs. The black spots indicate to scale the combined area of additional small park playground and athletic field requirements in the various neighborhoods. It is not intended that each of these spots should ultimately represent a single park to be acquired; they should be construed as approximate *minimum* requirements for the combination of quiet parks, playgrounds and athletic fields, exclusive of additional area that would be desirable for large parks.

The sections of Manhattan notably sub-standard as to park and play space, as well as athletic fields which were considered impracticable in view of the high cost of land on Manhattan, are the Chelsea-Greenwich Village part of town, the middle East Side, and upper Harlem.

In Brooklyn and Queens there are marked deficiencies in nearly every part of both boroughs. This is particularly noticeable in the broad belt extending all the way from Corona to Coney Island.

Despite the fact that The Bronx presents the best statistical record of any borough in respect to park area, there is still need for materially more space devoted to quiet parks, playgrounds and athletic fields. This is especially true in the Grand Concourse apartment house section and in the south central area of the borough. East Bronx is also lacking in sufficient play space to meet the needs of the anticipated population growth.

A glance at the Richmond section of the map in Figure 15, indicates the need for a well dis-

AREA SERVED BY EXISTING PARKS APRIL - 1937

EXISTING PARKS
AREA SERVED

Area served determined
by recreation standards
developed by the staff of the
NATION'S COMMITTEE ON CITY PLANNING,
based upon present population.

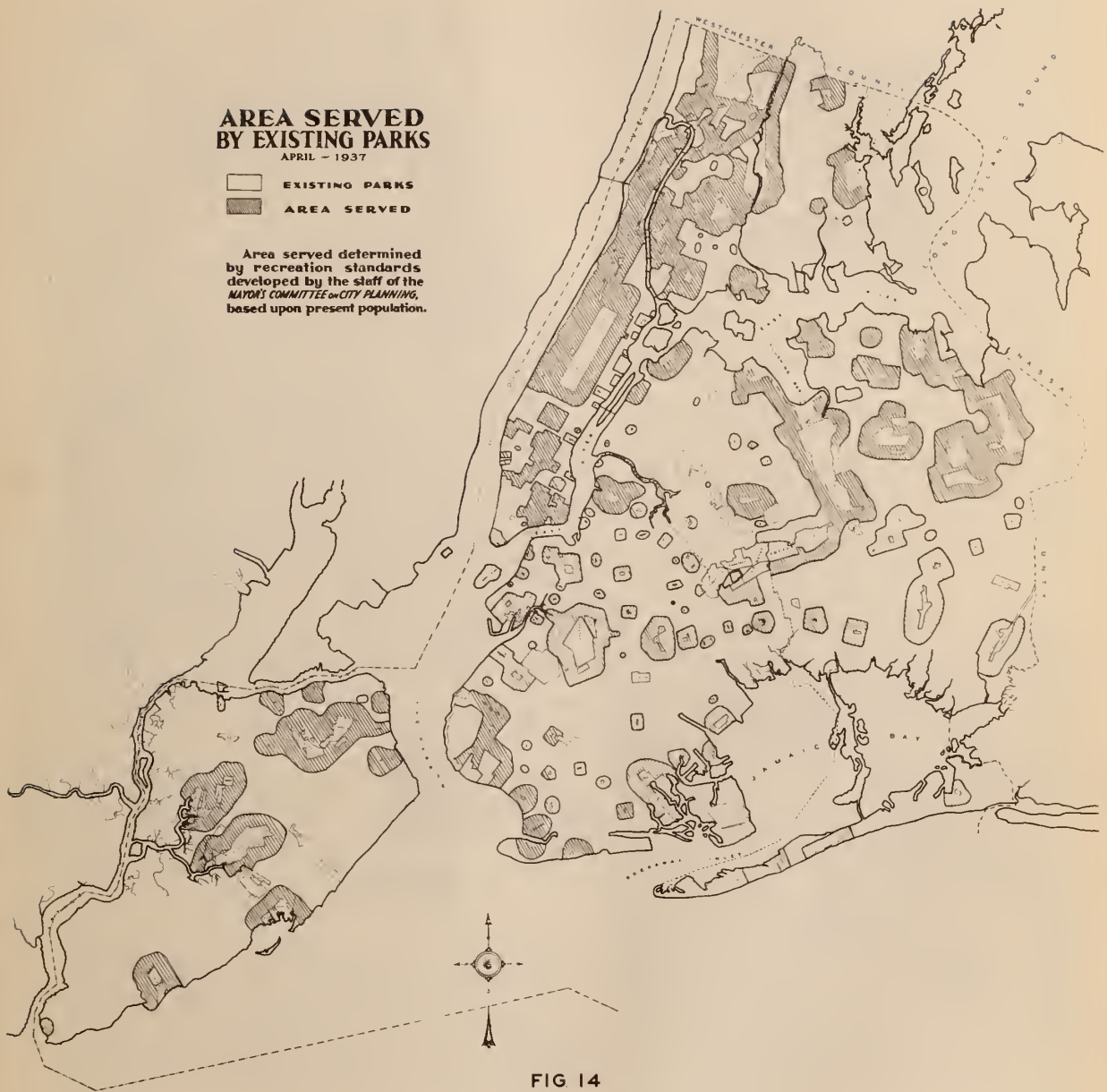


FIG 14

 EXISTING PARKS

 AREA SERVED

 PRED. NON-RESIDENTIAL AREA

 ADDITIONAL PARK ACREAGE REQUIRED

**PARK ACREAGE
REQUIRED BY 1970 AD**
APRIL-1937

- EXISTING PARKS
- AREA SERVED
- PRED. NON-RESIDENTIAL AREA
- ADDITIONAL PARK ACREAGE REQUIRED

Area served and additional park acreage required, determined by the staff of the MAYOR'S COMMITTEE ON CITY PLANNING, based upon the estimated 1970 population.

The map displays the geographical distribution of parks and projected future needs. Existing parks are shown as white polygons. Areas currently served are indicated by diagonal hatching. Dotted regions represent predicted non-residential areas. Black dots signify the additional park acreage required to serve these areas by 1970. The map also shows the coastline, major roads, and surrounding jurisdictions like Westchester County and Dutchess County.

FIG. 15

FIG. 15

tributed pattern of small parks, playgrounds and athletic fields designed to serve the many separate communities that are characteristic of the borough.

Area and Estimated Costs

The method of study adopted for analysis of the park problem has been described in earlier sections of this report, and the general pattern of needs is shown on accompanying maps, which are also discussed in the text. Having proceeded thus far, the staff was ready for the next and most important step—namely the tabulation of needed acreage, and calculation of the cost of carrying out the indicated program.

The cost of land on the scale involved in solving the park problem is admittedly difficult to predict with assurance. After careful consideration it was decided that the most practical approach would be to use the staff's detailed estimates of real property value, adjusted by the established equalization ratio of true to assessed value, and further adjusted by a factor determined by past experience of condemnation proceedings. In this way separate base values of real estate were worked out for each neighborhood that needs additional park and play area. The record of condemnation proceedings over a considerable number of years indicated that property is bought in at an average of 1.3 times its assessed value. This is believed to be on the liberal side, as recent eminent domain acquisitions have taken place at prices much closer to the current assessed valuations.

TABLE 27 Calculated Average Acquisition Cost Per Acre of Additional Small Park and Play Area, by Boroughs	
Borough	Cost of Acquisition per Acre
Manhattan	\$299,200
Bronx	186,700
Brooklyn	161,800
Queens	59,800
Richmond	16,000

Table 27 gives the average acquisition costs per acre for each borough, computed by adding up all of the many separate park and play areas required, each taken at its pre-determined unit cost for land plus buildings demolished. Attention should be called to the fact that the average acquisition cost in Manhattan is almost \$300,000 per acre or \$6.85 per sq. ft.

After investigation of past practice and experience, it was decided to assume the development

cost of quiet parks at \$5,000 per acre. These estimates are believed sufficient to cover grading, landscape treatment and purchase of equipment.

The summary of ultimate small park, playground and athletic field needs by boroughs is given in Table 28. This corresponds with the required areas indicated on Figure 15. The entire program adds up to 2,635 acres, of which 1,124 acres are situated in Brooklyn, 763 acres in Queens and 420 acres in The Bronx. The cost of acquisition as given in Table 28 is roughly 340 million dollars or the equivalent of \$3.00 per sq. ft. average for the city. Development cost adds about 19 million dollars to the acquisition cost, making the total bill for small parks, playgrounds and athletic fields roughly \$360,000,000. (13) Some compromise is essential between optimum needs and limitations of available funds. The section of this report devoted to "Recommended Park Program" explains that this compromise can be effected by spreading the park program over a longer term of years than would be used if more ample funds were available.

DISTRIBUTION & ESTIMATED COST OF NEEDED FACILITIES

Having determined the combined areas needed for quiet parks, playgrounds and athletic fields (Fig.15), attention was turned to the more detailed problem of segregating the local requirements for each of these classifications.

Playgrounds and Athletic Fields

In Fig. 16, the needed separate playgrounds and athletic fields (*not* the quiet parks) are shown as a pattern that would give adequate facilities for the ultimate population of the five boroughs. This map indicates existing playgrounds and athletic fields as well as those that are proposed. In some cases the additions can be provided within the confines of established parks. In other cases the acquisition of new land will be required.

For the purposes of Fig. 16, it was assumed that a playground for young children can adequately serve an area with a radius of $\frac{3}{8}$ of a mile; and an athletic field, a radius of $\frac{3}{4}$ of a mile. The size of playground or athletic field (not indicated on the map) will necessarily vary with the anticipated population in the theoretical circular area that is contributory to it. In cases where the population density is very high, somewhat closer spacing of playgrounds was resorted to. It must be emphasized that this play space pattern is intended to be schematic rather than precise. No exact locations could be determined within the limi-

(13) The apportionment of area between quiet parks, playgrounds and athletic fields is given in Table 35.

TABLE 28
Additional Area Required for Small Parks, Playgrounds and Athletic Fields
Combined, with Cost Estimates

Borough	Acreage Required	Cost of Acquisition	Cost of Development	Total Cost
Manhattan	102.1	\$ 30,549,000	\$1,096,000	\$ 31,645,000
Bronx	420.2	78,451,000	2,879,000	81,330,000
Brooklyn	1,124.6	181,960,000	7,041,000	189,001,000
Queens	763.6	45,663,000	6,063,000	51,726,000
Richmond	224.4	3,590,000	2,050,000	5,640,000
Total	2,634.9	\$340,213,000	\$19,129,000	\$359,342,000

tations of staff and time available. It is suggested that it would be appropriate to make a detailed examination of neighborhood characteristics and available sites, as a logical next step in the study of this subject.

Evidently, the provision of adequate play space in connection with future school construction would reduce by that much the extent of the need to be met within the scope of the program described in this report.

The staff prepared a series of very detailed borough maps showing precisely what recreational and athletic facilities are now available in each existing park and playground throughout the city. On these maps symbols are used to indicate athletic fields, golf courses, tennis courts, small children's playgrounds, stadiums, swimming pools, and other typical facilities. The maps also carry the same distribution pattern for future facilities that is given on Fig. 16. This series of maps is in color and unfortunately cannot be reproduced to good advantage on the small scale that would be necessary for inclusion in this report.

It will be observed that each of the playgrounds and athletic fields in Fig. 16 is identified by a number. These numbers are keyed with a series of detailed tables giving the required area of the particular playground or athletic field, and its estimated acquisition and development cost. Limitations of space make it impossible to include these statistical tables in the present report, but the data are summarized in Table 28.

Table 29 summarizes the number of playgrounds and athletic fields that are indicated graphically on Fig. 16. At the time this tabulation was made (autumn 1937) there were 242 existing playgrounds exclusive of those on school property. The studies of the staff indicate a need for 511 additional playgrounds, of which 107 can be developed in existing parks.

The situation with respect to athletic fields is less critical. There were found to be 362 existing athletic fields and only 42 additional fields are indicated as needed, of which over half could be provided within present parks. It is significant that the existing distribution of athletic fields in Manhattan is such that no part of the borough is more than three-quarters of a mile from a field. No additional athletic fields for Manhattan are included in Table 29, although it is realized that the high population density results in serious overcrowding of many of the present facilities. Unfortunately, as already pointed out in the discussion of standards, it is hardly possible to provide really adequate space for football, baseball and similar games, in areas already built-up well-nigh solidly with apartments. In other words, the deficiencies occurred in neighborhoods already supplied with large parks or small quiet parks, in which the opportunities for supplying active play space have not been exhausted.

Table 30 summarizes the park and playground needs by boroughs, with separate figures for each classification. It also indicates the extent to which existing parks may be utilized as sites. Cost figures for acquisition and development have been worked out and included in the table. The total needed additional area, for the city as a whole, is 1,916 acres, comprising 1,506 acres of playgrounds of which 277 acres can be in existing parks; and 410 acres of athletic fields, of which 70 acres would be in the present park system. The cost of this part of the program totals \$187,501,000, of which 93 percent is site acquisition and the balance represents development and equipment. Playgrounds for young children as distinct from athletic fields, account for \$148,040,000 or 79 percent of the grand total of \$187,501,000.

The distribution of the program over the five boroughs is easier to visualize in terms of the per-

PLAYGROUNDS & ACTIVE RECREATION FACILITIES REQUIRED BY 1970 A.D. DECEMBER 1937

Legend

EXISTING PLAYGROUND FACILITIES	○	EXISTING ACTIVE RECREATIONAL FACILITIES	□
PLAYGROUND FACILITIES REQUIRED IN EXISTING PARKS	◐	ACTIVE RECREATIONAL FACILITIES REQUIRED IN EXISTING PARKS	◑
ADDITIONAL PLAYGROUND FACILITIES REQUIRED	●	ADDITIONAL ACTIVE RECREATIONAL FACILITIES REQUIRED	■

Approximate location for additional facilities required to serve the estimated 1970 population as determined by the staff of the *MAYOR'S COMMITTEE ON CITY PLANNING*.

Additional large parks recommended by the *REGIONAL PLAN ASSOCIATION*

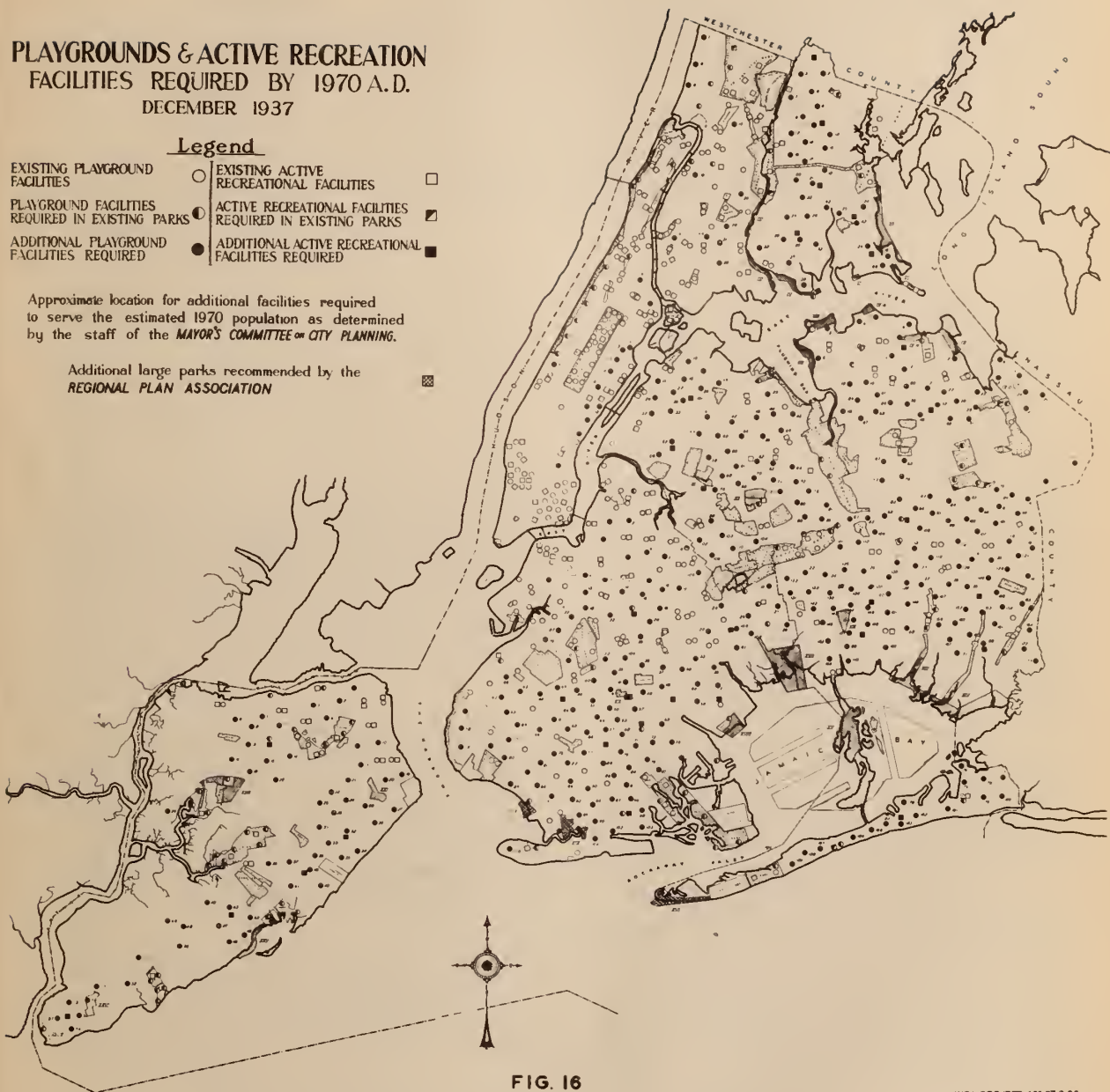


FIG. 16

TABLE 29
Number of Additional Playgrounds and Athletic Fields Required by Boroughs

<u>PLAYGROUNDS</u>	Manhattan	Bronx	Brooklyn	Queens	Richmond	Total
Present No. of Playgrounds	84	33	72	42	11	242
Playgrounds that can be developed in present parks	16	13	29	22	27	107
Playgrounds to be provided in unserved areas (Basis $\frac{3}{8}$ mile radius)	7	38	110	193	56	404
<u>ATHLETIC FIELDS</u>						
Present No. of Athletic Fields with either stadium, swimming pool, tennis (5 or more courts) athletic field, basketball or all	105	57	119	59	22	362
Athletic Fields that can be developed in existing parks	0	4	8	9	1	22
Athletic Fields to be provided in unserved areas (Basis $\frac{3}{4}$ mile radius)	0	4	1	11	4	20

centages in Table 31 than by studying the detailed cost figures of Table 30. The very uneven distribution shown in Table 31 is accentuated when the needs are expressed in terms of the estimated ultimate borough populations. Referring to Table 32, it is at once apparent that provision of play space has a long way to go, if it is to keep pace with the anticipated population growth of the boroughs.

Small Quiet Parks

The formulae used for deriving the area requirements tabulated in Table 28 were designed to give the additional *combined* area needed for small parks, playgrounds and athletic fields. The fact that some of the play spaces can be provided in existing parks does not decrease the combined *new area* that should be secured, as the extent of adequacy of all existing parks had already been taken into account, on the basis of the actual area of each.

Table 30 described in the previous section, represents the summation of required playground and athletic field requirements, determined by spotting of play spaces of appropriate size in a pattern that will serve all sections without excessive walking distance.

In order to obtain the required small park areas and their estimated cost, it therefore remained only to subtract the figures in Table 30 from their corresponding items in Table 28. The results are

given in Table 33. No attempt has been made to "spot" each needed quiet park on a map, as this would have involved a detailed study of potentially available sites far beyond the time and resources of the staff. Table 33 gives only the borough totals, but more detailed figures for each neighborhood can readily be tabulated from the staff records. These will give, in effect, the proper apportionment of each of the circular spots on Fig. 15, as between quiet parks, playgrounds, and athletic fields.

Referring again to Table 33, it will be noted that the area needed for new quiet parks in Brooklyn exceeds the indicated needs of the four other boroughs combined. This is but another instance of rapid population growth having taken place over the years, without sufficient attention being given to the progressive need for park area.

The quiet park program totals roughly \$171,-841,000, of which nearly 97 percent represents cost of acquisition as distinct from development.

In many cases, small parks designed for relaxation and breathing space can be provided at the same location as a needed playground. This would be in line with the general practice up to recent years of correcting the shortage of playgrounds almost exclusively by carving new ones out of established parks. This is not however the most desirable solution, as a noisy playground with apparatus designed for young children is in-

TABLE 30
Summary of Additional Playground and Athletic Field Requirements
By Boroughs, with Estimated Costs in Thousands of Dollars

Borough	Acreage	Acquisition Cost	Develop. Cost*	Total Cost	Borough	Acreage	Acquisition Cost	Develop. Cost*	Total Cost
MANHATTAN					QUEENS				
NEW ACQUISITIONS Playgrounds Athletic Fields	61.71	\$18,464	\$432	\$18,896	NEW ACQUISITIONS Playgrounds Athletic Fields	519.33 130.00	\$31,056 7,774	\$3,635 1,105	\$34,691 8,879
Total	61.71	\$18,464	\$432	\$18,896	Total	649.33	\$38,830	\$4,740	\$43,570
ADDITIONAL FACILITIES IN EXISTING PARKS Playgrounds Athletic Fields	65.99 .....	.....	\$462	\$462	ADDITIONAL FACILITIES IN EXISTING PARKS Playgrounds Athletic Fields	58.90 40.00	..... .....	\$412 340	\$412 340
Total	65.99	.....	\$462	\$462	Total	98.90	.....	\$752	\$752
BOROUGH TOTAL	127.70	\$18,464	\$894	\$19,358	BOROUGH TOTAL	748.23	\$38,830	\$5,492	\$44,322
BRONX					RICHMOND				
NEW ACQUISITIONS Playgrounds Athletic Fields	147.21 70.00	\$27,484 13,069	\$1,030 595	\$28,514 13,664	NEW ACQUISITIONS Playgrounds Athletic Fields	140.00 50.00	\$2,240 800	\$980 425	\$3,220 1,225
Total	217.21	\$40,553	\$1,625	\$42,178	Total	190.00	\$3,040	\$1,405	\$4,445
ADDITIONAL FACILITIES IN EXISTING PARKS Playgrounds Athletic Fields	30.43 30.00	..... .....	\$213 26	\$213 26	ADDITIONAL FACILITIES IN EXISTING PARKS Playgrounds Athletic Fields	67.50 .....	..... .....	\$473	\$473
Total	60.43	.....	\$239	\$239	Total	67.50	.....	\$473	\$473
BOROUGH TOTAL	277.64	\$40,553	\$1,864	\$42,417	BOROUGH TOTAL	257.50	\$3,040	\$1,878	\$4,918
BROOKLYN					CITY TOTALS				
NEW ACQUISITIONS Playgrounds Athletic Fields	360.05 90.00	\$58,256 14,562	\$2,520 765	\$60,776 15,327	NEW ACQUISITIONS Playgrounds Athletic Fields	1,228.30 340.00	\$137,500 36,205	\$8,597 2,890	\$146,097 39,095
Total	450.05	\$72,818	\$3,285	\$76,103	City Total	1,568.30	\$173,705	\$11,487	\$185,192
ADDITIONAL FACILITIES IN EXISTING PARKS Playgrounds Athletic Fields	54.72 .....	.....	\$383	\$383	ADDITIONAL FACILITIES IN EXISTING PARKS Playgrounds Athletic Fields	277.54 70.00	..... .....	\$1,943 366	\$1,943 366
Total	54.72	.....	\$383	\$383	City Total	347.54	.....	\$2,309	\$2,309
BOROUGH TOTAL	504.77	\$72,818	\$3,668	\$76,486	GRAND TOTAL	1,915.84	\$173,705	\$13,796	\$187,501

(*) Development assumed at \$7,000 per acre for Playgrounds, and \$8,500 for Athletic Fields

compatible with the atmosphere of restfulness that should be emphasized in parks that are to be used primarily by adults in search of quiet, and by mothers with infants at the baby carriage age. The newer playgrounds, by contrast, have more frequently been acquired and developed solely for active recreation, and have none of the attributes of formal parks.

Private Park and Playground Areas

There is reason for hoping that future private construction will make some provision for children's play space and landscaped areas with all the attributes of quiet parks. This is possible in any large-scale housing project, provided that the buildings do not cover too large a proportion of the land. Unquestionably the excellent example set by publicly financed housing projects such as Williamsburg is exercising a strong influence on private builders. Recent trends all point to a realization of the importance of adequate open space in apartment developments. This new era is evidenced by the liberal open space provided in the plans for the Metropolitan Housing Project in The Bronx, with its building coverage of 30 percent and its large open areas for landscaped park-like spaces and active recreation. It is perhaps not too much to say that the time is near at hand when open space suitable to the needs of tenants will be provided by the owner, practically as a matter of course, in order that his apartments may have an equal footing in a competitive market.

In other cities it is already common practice for real estate developers to set aside a part of their sub-divisions for park use, and then to dedicate these park sites to the city free and clear and without compensation. This is no gesture of philanthropy, but rather the practical expression of sound business acumen. It assures for these

new neighborhoods a degree of permanent attractiveness and amenity that cannot otherwise be achieved.

To the extent that new residential areas provide their own quiet parks and playgrounds as an intrinsic feature of their plans, the need for public action to remedy park deficiencies will be lessened. For obvious reasons, the park needs that are presented statistically in this report cannot be tempered by quantitative estimates of the potentialities of integral park space being supplied in private developments. That such space is being supplied in increasing degree is, however, an encouraging sign of the times.

Additional Large Parks

The question of the extent to which additional parks of large area should be added to the present system cannot readily be evaluated by the methods applied to the small park and play space problem. A large park with its wide range of facilities and attractions brings people from long distances and has no definable area of influence. The staff has studied the distribution of existing large parks and suggests that additions should be made at strategic locations, whenever finances permit and outstanding opportunities for land acquisition offer themselves.

A list of recommendations was made available to the Planning Committee by the Regional Plan Association. This list is given in Table 34. It should not be construed as bearing the endorsement of the Planning Committee or its staff, but is believed nevertheless to present a well rounded group of proposals, manifestly in line with the needs of the situation and the evolving pattern of the city that a well-considered Master Plan should be able to bring to reality.

An analysis of the Regional Plan recommendations was made by the staff in order to show what the program involves in terms of land areas

TABLE 31
Percent Distribution of Required Additional Playground and Athletic Field Area by Boroughs

Borough	Playgrounds	Athletic Fields	Playgrounds plus Athletic Fields
Manhattan	8.5	....	6.6
Bronx	11.8	24.4	14.5
Brooklyn	27.5	21.9	26.4
Queens	38.4	41.5	39.1
Richmond	13.8	12.2	13.4
New York City	100.0	100.0	100.0

and probable acquisition and development costs. The cost figures (see Table 34) were arrived at by the same process used for determining the cost of small parks. The 25 recommended large parks have a combined area of 5,204 acres.

They range in size from 13 acres for a park at Baxter Creek Inlet to 924 acres for a proposed park in the Jamaica Bay area. The locations of all these large parks are cross-hatched on the maps reproduced in Figure 16. It will be noted that for the most part they are situated in outlying locations. The total cost of carrying out this program is estimated to aggregate \$59,472,000. Because the land involved is relatively cheap, the cost of development becomes a much larger proportionate item than in the case of small parks and playgrounds. It represents \$26,020,000, or 43.5 percent of the total, while acquisition accounts for 56.5 percent. Two of the recommended large park sites are already in public ownership and thus involve no expense for acquisition, while 5 other sites are partially publicly owned.

It is believed that the Regional Plan proposals merit serious consideration, although so ambitious a program will require many years to carry out, because it cannot well be financed at the expense of other park and playground needs.

RECOMMENDED PARK PROGRAM

It became clear to the staff that the scope of the park problem, as tabulated and described in the foregoing sections of this report, exceeds any reasonable probability of near-term financing. This did not deter the staff from going through the task of presenting the full magnitude of the need. In no other way is it possible to bring home to the people the importance of the problem and the extent to which it was neglected during the long years of the city's growth. Much has been done since 1933 to make up for lost time, but New York has grown so great that no

complete solution of the whole park program can now be achieved other than as a long and gradual process. It is important at this time that the people should realize what the City of New York ought to have in the way of parks and playgrounds, so that they may be able to look forward with clearer sight and greater vision. Lack of foresight in the provision of parks in the past has been tragic, they contribute so much to the health and welfare of the youth of the city. Remedying of defects, now so well under way, involves acquisition of large tracts of land that once were cheap but now are high in cost. However, contrary to the general belief of many officials and private citizens, the problem is by no means insoluble.

After completing the study of park requirements and estimated costs, it was necessary to adjust the program to the city's indicated financial resources, without prejudice to other essential public improvements. Careful analysis of the situation led to the conclusion that it would be better to spread the relatively large program for park acquisition over a long term of years, since immediate resources are less than they are anticipated to be in the future. This means, in essence, a long period of gradual progress in curing park deficiencies rather than any immediate but partial solution.

Table 35 summarizes the recommendations of the staff for acquisition of additional park and play space area, and also includes the Regional Plan Association's proposals for large parks. The total area figures for playgrounds and athletic fields, quiet parks and large parks given in Table 35 are tabulated separately in Tables 30, 33 and 34 respectively. The summation of cost figures will be found in Table 36.

It should be noted that the recommended park program does not provide for future parkways. Parkway, though legally the same as parks, par-

TABLE 32
Additional Playground and Athletic Field Requirements in Acres
Per 100,000 Ultimate Population, by Boroughs
Note: See Table 38 for Estimates of Ultimate Population

Borough	Playgrounds	Athletic Fields	Playgrounds plus Athletic Fields
Manhattan	7.6	....	7.6
Bronx	9.0	5.0	14.0
Brooklyn	12.4	2.7	15.1
Queens	30.4	9.0	39.4
Richmond	61.9	14.9	76.8
New York City	16.3	4.5	20.8

take of the nature of highways. The staff therefore included the costs of suggested parkway projects in the highway program. Development of the marginal area of new parkway property as quiet park and play space would moderately reduce the area and cost requirements for separate small parks and playgrounds, indicated by the statistics in this report.

Referring to Table 35 it will be noted that the entire park program involves the acquisition of 7,839 acres. This of course, excludes the 348 acres of playgrounds and athletic fields to be developed within existing parks (Table 30). Table 36 shows that the total cost for acquisition and development adds up to \$418,814,000.

Comparative study of needed expenditures for other improvements — schools, libraries, sewers, water supply, transit, etc., — indicated that this total for parks could be undertaken as a 32-year program.

An appropriate allowance for capital depreciation and replacement of equipment and landscape features, both in existing parks and in new parks to be acquired, must be included when the park recommendations are set up as a long-term improvement program. On the basis of past experience, 2.5 percent per annum was assumed ample for this purpose. Application of this allowance to the present value of depreciating items in the existing park system and in the contemplated park acquisitions, gives roughly \$67,000,000 as the total of the depreciation and replacement cost during the 32 years of the program. The aggregate amount of the park program thus becomes \$485,654,000, which is recommended for financing over the years 1939 to 1970 inclusive, in part from capital budget funds and in part by local, borough and city-wide assessments.

Reference should be made to the "Program For Improvements", Volume III of this series of reports, for the division of financing between the capital program and the assessable schedule, and

for the detailed apportionment of each phase over the three 6-year periods, 1939-1944, 1945-1950 and 1951-1956. It suffices in this report to abstract the significant totals, which are given in Table 37.

REVIEW OF PARK PROGRAM

If the city carries out the recommended park program, involving as it does a very large aggregate cost, how will its ultimate park system compare with that which the city has today? The statistical answer to this question is given in Table 38 where parallel columns present the figures for existing and ultimate park area, parks per 100,000 population, and percent of each borough devoted to park land.

The total park area would be increased from 18,835 acres (January 1, 1938) to 26,674 acres, most of the additional land being in Brooklyn and Queens. The park area per 100,000 population would change but little, increasing from 274 to 290 acres. Thus the new parks estimated to be required would hardly more than keep even with population growth. They would however be distributed in such a way as to serve primarily those areas that are now deficient in park facilities. In The Bronx, with its liberal area of existing parks, the ultimate acreage per 100,000 population would actually be materially less than at present, despite a moderate increase in total park acreage.

The proportion of gross city area devoted to parks would rise from 9.5 percent to 13.5 percent, with the largest increments in Brooklyn and Queens, the latter changing from only 6.5 up to 11.2 percent.

It would be a mistake to appraise the recommended ultimate park system solely in terms of acres and dollars, important as it is to face the question of costs, and to maintain a businesslike attitude toward every problem that involves the expenditure of public funds. Let us take time also to appraise the results that can be achieved, in

TABLE 33
Summary of Additional Small Park Requirements by Boroughs, with Estimated Costs

Borough	Acres	Cost to Acquire	Development @ \$5,000 per acre	Total Cost
Manhattan	40.39	\$ 12,085,000	\$ 202,000	\$ 12,287,000
Bronx	202.99	37,898,000	1,015,000	38,913,000
Brooklyn	674.55	109,142,000	3,373,000	112,515,000
Queens	114.27	6,833,000	571,000	7,404,000
Richmond	34.40	550,000	172,000	722,000
New York City	1,066.60	\$166,508,000	\$5,333,000	\$171,841,000

TABLE 34
Summary of Additional Large Park Requirements Proposed by Regional Plan Association,
with Estimated Costs Prepared by Planning Committee Staff

Borough	Park No.	Location	Area in Acres	Approximate Assessed Value of Land	Cost of Acquisition (value x 1.3)	Development Cost@ \$5,000 per acre	Total Cost
Manhattan	2	Corlears Hook Park Extension	40	\$3,602,000	\$4,682,000*	\$200,000	\$4,882,000
		<u>Total</u>	40	3,602,000	4,682,000*	200,000	4,882,000
Bronx	4	East Bronx Park Extension	304	2,384,000	3,100,000	1,520,000	4,620,000
	5	Baxter Creek Inlet	13	91,000	118,000	65,000	183,000
	6	East Shore of The Bronx	333	571,000	742,000*	1,665,000	2,407,000
		<u>Total</u>	650	3,046,000	3,960,000	3,250,000	7,210,000
Queens	7	East Shore of Flushing Bay	110	445,000	579,000*	550,000	1,129,000
	8	Chisholm Park Extension	98	512,000	666,000	490,000	1,156,000
	9A	Park at Whitestone Bridge Approach	39	340,000	442,000	195,000	637,000
	9B	Little Bay	113	1,624,000	2,111,000	565,000	2,676,000
	9C	Willetts Point	164	1,143,000	1,486,000	820,000	2,306,000
	9D	Little Neck Bay	132	1,610,000	2,093,000	660,000	2,753,000
	11	Park Adjacent to Mount Zion Cemetery	32	753,000	979,000	160,000	1,139,000
	12	Juniper Valley Park Extension	98	640,000	832,000	490,000	1,322,000
	13	Aqueduct Race Track	102	1,111,000	1,444,000	510,000	1,954,000
	14	East Jamaica Bay	924	2,415,000	3,140,000	4,620,000	7,760,000
	15	Islands of Jamaica Bay	542	City Owned	City Owned	2,710,000	2,710,000
	16	Rockaway Point	185	1,536,000	1,997,000	925,000	2,922,000
		<u>Total</u> ...	2,539	12,129,000	15,769,000	12,695,000	28,464,000
Brooklyn	17	Spring Brook	565	1,015,000	1,320,000*	2,825,000	4,145,000
	18	Canarsie Park Extension	119	City Owned	City Owned	595,000	595,000
	19	Gravesend Bay and North of Coney Island Creek	732	1,170,000	1,521,000*	3,660,000	5,181,000
	20	Flatbush Water Company Property	34	148,000	192,000	170,000	362,000
		<u>Total</u>	1,450	2,333,000	3,033,000	7,250,000	10,283,000
Richmond	21	Park at Approach to Narrows Crossing	94	1,638,000	2,129,000	470,000	2,599,000
	23	Extension of New Springville and Willow Brook Park	211	2,532,000	3,292,000	1,055,000	4,347,000
	25	Extension of Marine Park	76	30,000	39,000	380,000	419,000
	26	Richmond Valley	79	344,000	447,000	395,000	842,000
	27	Ward Point	65	78,000	101,000	325,000	426,000
		<u>Total</u> ...	525	4,622,000	6,008,000	2,625,000	8,633,000
GRAND TOTAL New York City			5,204	23,399,000	33,452,000	26,020,000	59,472,000
Note: *Denotes cost of portion to be acquired; balance is already city owned							
Park No. 2— 1 acre City Owned 17—150 acres City Owned 6—264 acres City Owned 7— 4 acres City Owned 19— 57 acres City Owned							

TABLE 35
Recapitulation of Additional Park, Playground and Athletic Field Areas Required in Acres,
Including Regional Plan Association Proposals for Large Parks

Borough	Playgrounds	Athletic Fields	Small Parks	Large Parks (Regional Plan Association)	Total
Manhattan	61.71	....	40.39	40	142.1
Bronx	147.21	70.00	202.99	650	1,070.2
Brooklyn	360.05	90.00	674.55	1,450	2,574.6
Queens	519.33	130.00	114.27	2,539	3,302.6
Richmond	140.00	50.00	34.40	525	749.4
New York City	1,228.30	340.00	1,066.60	5,204	7,838.9

TABLE 36
Total Costs of Recommended Program by Boroughs, Figures in Thousands of Dollars

Borough	Playgrounds	Athletic Fields	Small Parks	Large Parks	Total
Manhattan	19,358	....	12,287	4,882	36,527
Bronx	28,727	13,690	38,913	7,210	88,540
Brooklyn	61,159	15,327	112,515	10,283	199,284
Queens	35,103	9,219	7,404	28,464	80,190
Richmond	3,693	1,225	722	8,633	14,273
New York City	148,040	39,461	171,841	59,472	418,814

their relation to a pattern for better living in the City of New York.

By carrying out the program envisaged in this report, our city would ultimately have a playground, an athletic field and a small park within reasonable walking distance of every home, except in Manhattan where additional athletic fields may not be practicable, in view of the high cost of land. In the course of time, however, the extensive rebuilding of substandard areas in Manhattan with new large scale housing, may be expected to provide the play and other open space needed for good living conditions. The new facilities included in the foregoing program would be of sufficient though by no means over-liberal size. There would also be extensive additions to the system of large parks, so that travel distance would be reduced and the present parks less crowded. These objectives are a far cry from Utopian conceptions, and can in no sense be construed as the products of a perfectionist philosophy. In point of fact, the

TABLE 37
Recommended Distribution of Park Program Cost
by Groups of Years, 1939-1970

Period	Recommended Total Expenditures for Park Program
1939 to 1944 incl.	\$ 88,080,000
1945 to 1950 "	89,610,000
1951 to 1956 "	<u>91,140,000</u>
Total, 18 years	268,830,000
Balance, 1957-1970 incl.	<u>216,824,000</u>
Grand Total	\$485,654,000

recommended program would fall a long way short of ideal conditions. Nevertheless, it would give a degree of park adequacy far greater than anything New York City has ever known, and by the same token, far greater than all but a few outstanding cities have been able to achieve.

TABLE 38
Present and Proposed Ultimate Park Areas including Playgrounds and Athletic Fields

Borough	Borough Area	Ultimate Population	Park Area		Park Area per 100,000 Population		Percent of Area in Parks	
			Existing	Ultimate	Existing	Ultimate	Existing	Ultimate
Manhattan	14,211	1,678,000	2,520	2,662	146	157	17.7	18.7
Bronx	27,351	1,987,000	5,159	6,229	400	314	18.9	22.8
Brooklyn	47,660	3,327,000	3,786	6,361	149	191	8.0	13.4
Queens	70,370	1,900,000	4,589	7,892	400	415	6.5	11.2
Richmond	38,738	335,000	2,781	3,530	1,735	1,052	7.2	9.1
New York City	198,330	9,227,000	18,835	26,674	274	290	9.5	13.5

Rapid Transit

INTRODUCTION

In 1936, the Mayor's Committee on City Planning proposed that the WPA undertake, as part of a general city planning study, an investigation of "Means of Communication," including Streets and Highways, Railroads, Street Cars and Motor Buses, Rapid Transit, Waterways, and Airways. Limitations of staff and time, however, made it possible to carry out only two of these investigations, i. e., Highways, which is discussed in the first chapter of this Volume, and Rapid Transit. Surface transit has only been touched upon in its relationship to total and rapid transit traffic volume.

The primary function of a transit system is to provide convenient transportation of people between their homes and places of work, within reasonable travel time, and to facilitate movement between focal points in order to promote the social and economic life of the city. In New York rapid transit is so requisite to mass transportation and exerts such tremendous influence upon city growth that it must be treated as one of the primary elements in any comprehensive study of the city's problems.

Consideration was necessarily given to the influence of transit in the other city-wide studies conducted for the Mayor's Committee. The Rapid Transit study proper is concerned with determining the adequacy of service on lines existing and under construction, as well as the additional transit facilities that would be required in the future by the population distribution indicated by the Residential Area Study assuming that no substantial shift in working centers occurred. This study considers only those rapid transit lines charging a five-cent fare or the construction of which, in whole or in part, has been paid from city funds.⁽¹⁴⁾

THE PRESENT SYSTEM

There are four Rapid Transit Systems: the Interborough; the Manhattan Elevated; the Brooklyn-Manhattan; and the Independent, which is operated by the city. Since the Interborough Subway and the Manhattan Elevated are operated by the I. R. T., this report generally refers to the lines of the three operating systems as the I. R. T., B. M. T., and the Independent. The routes of these systems are delineated on Figure 17 according to operating agency, and the structure of each line is indicated as subway or elevated. (Demolition of the 6th Avenue El was completed during 1939).

Extensive studies by the Regional Plan of New York and Environs, and the Board of Transportation, indicate that rapid transit "serves" an area extending one-half mile on either side of each line. The area served is shown on Figure 17 by a thin line paralleling each route. The staff of the Mayor's Committee estimates that the area served by transit accounts for more than 32 percent of the gross area of New York City. This estimate indicates that practically all Manhattan, 43 percent of The Bronx, 57 percent of Brooklyn and 20 percent of Queens lie within the area served. Since Richmond has no rapid transit connections direct to the other boroughs, it is not "served" by transit.

Population Served

The Board of Transportation has analyzed the decennial population census to determine the number of persons living in the area served by rapid transit. Comparing the resulting figures with the population of the entire city, the staff found that since 1900 over four-fifths of the city's inhabitants

⁽¹⁴⁾ This study was completed in 1938 and the original report was drafted in January, 1939.

TABLE 39
Population Served by Rapid Transit
(Data from the Board of Transportation)

Year	Population in Area Served	Population of Entire City		Population of 4 Boroughs	
		Total	% in Area Served	Total	% in Area Served
1900	2,761,344	3,437,202	80	3,370,181	82
1910	3,961,342	4,766,883	83	4,680,914	85
1920	4,933,347	5,620,048	87	5,503,517	90
1930	5,752,738	6,930,446	83	6,772,100	85

have lived within one-half mile of rapid transit lines. Since Richmond was omitted from this study, it is more pertinent to compare the number of people served with the residential population of the four boroughs provided with rapid transit. Table 39 shows that the proportion of the population living within one-half mile of transit lines in Manhattan, Bronx, Brooklyn and Queens has risen from 82 percent in 1900 to 90 percent in 1920, but stood at 85 percent in 1930.

The influence of rapid transit upon the development of the city is also evident in the greater concentration of population within the area served by rapid transit. Analyses of the Federal census by the Board of Transportation show that the density of population in the one-half mile zone on either side of subway lines is generally greater than, and in the case of some lines more than triple the average density for the boroughs. As might be expected, the average density of population within the area served, as compared with the average population density of the borough, varies as between individual lines and between the boroughs. However, the figures in Table 40 are representative and illustrate the heavier concentration of population living within the area served by rapid transit. Although the 7th Avenue I. R. T. Subway in Manhattan traverses areas served by other lines, it is interesting to note that the density of population within one-half mile had increased from about 1.5 in 1910 to over 2 times the average density of the borough by 1930. Table 40 shows an even greater relative concentration adjacent to the 3rd Avenue Elevated in The Bronx, but here again there is

some overlapping of the half-mile zone with the areas served by other lines, as is also the case with the Myrtle Avenue line in Brooklyn. The area served by the Flushing line in Queens is almost free of overlapping (the Independent Subway was not in operation in 1930) and the density of population in the one-half mile zone has been over 2 times the average density for the entire borough since 1920.

Concentration of Working Population

The 1934 Real Property Inventory enumerated, among other things, the Daytime Population, which is defined as the persons regularly working in a structure or an area, regardless of place of residence. Since it does not include transients in hotels, children in schools, nor visitors to office buildings, the Daytime Population is practically the same as permanent "working" population.

The 1934 "Working" Daytime Population of New York City was reported as in excess of 2,140,000 of which 70 percent was found in Manhattan, about 5 percent in The Bronx, 17 percent in Brooklyn, and 6 percent in Queens. An analysis of the Real Property Inventory material reveals that there were 1,257,100 persons working in Manhattan south of 60th Street, or nearly 59 percent of the total Daytime Population. Unfortunately it is not practicable to reproduce in this report the color map, prepared by the Mayor's Committee staff, which indicates the working population of each block in the city. This map graphically shows that there are no concentrations of working population elsewhere in the city comparable with

TABLE 40
Population Density Within ½ Mile of Rapid Transit Lines
(Data from the Board of Transportation)

Line and Borough	Population Densities by Years			
	1900	1910	1920	1930
7th Ave. I. R. T.—Manhattan	*	244	284	274
Average Density in Manhattan	130	164	161	131
3rd Ave. Elevated—Bronx	54	102	129	148
Average Density in the Bronx	7	16	27	46
Myrtle Ave. Line—Brooklyn	116	132	143	133
Average Density in Brooklyn	24	34	42	54
Flushing Line—Queens	*	*	14	35
Average Density in Queens	2	4	7	15

*Line not operating at time

MAYOR'S COMMITTEE ON CITY PLANNING THE CITY OF NEW YORK

FIORELLO H. LA GUARDIA
MAYOR



TIMOTHY J. SULLIVAN
CHAIRMAN

RAPID TRANSIT

FEBRUARY — 1937

SCALE
0 4000' 8000' 12000'

SUBWAY I.R.T. ELEVATED JOINTLY OPERATED
B.M.T. I.R.T. & B.M.T. JOINTLY OPERATED

INDEPENDENT

STATIONS
EXPRESS LOCAL

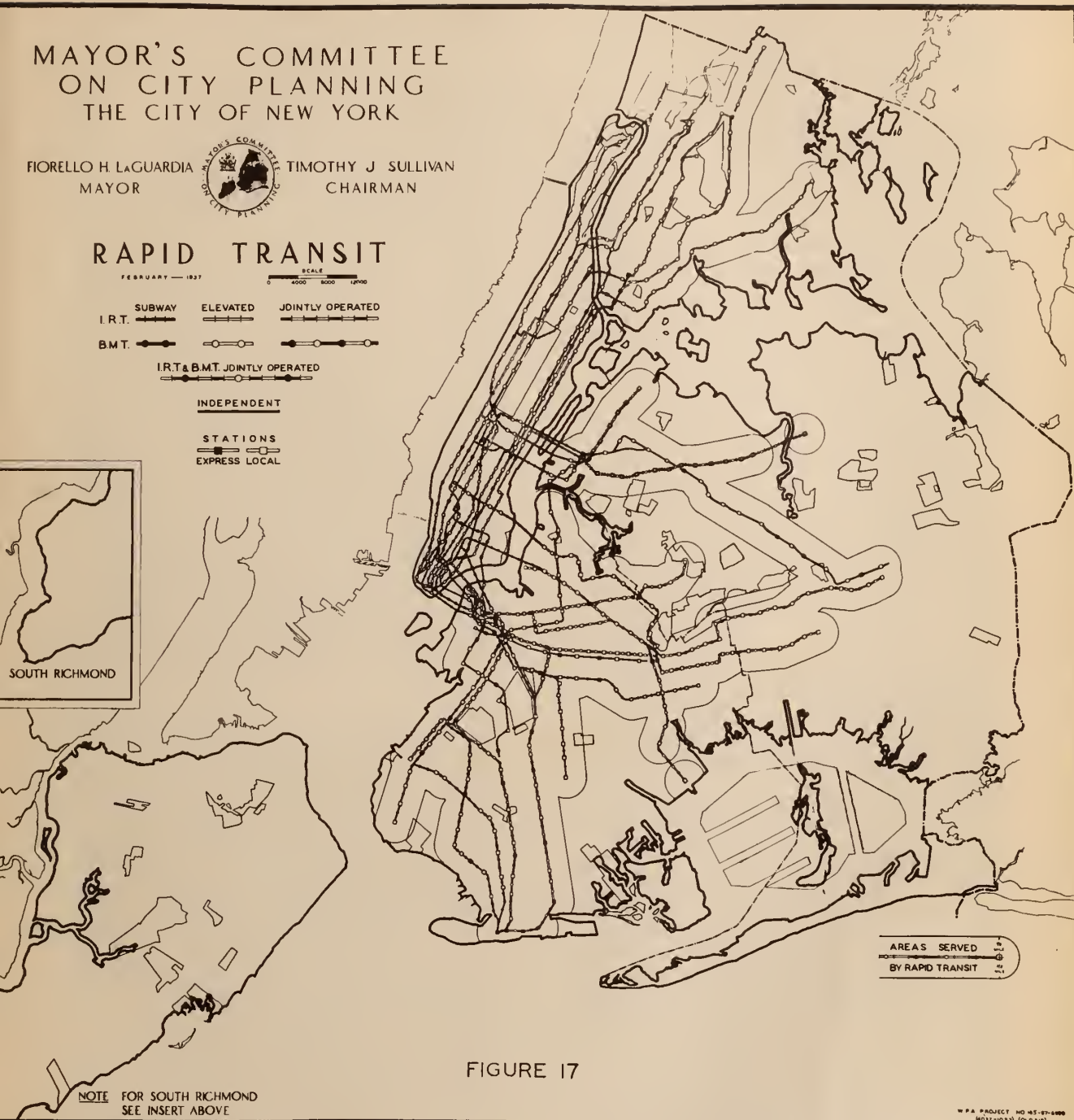


FIGURE 17

NOTE FOR SOUTH RICHMOND
SEE INSERT ABOVE

AREAS SERVED
BY RAPID TRANSIT

the great number of workers south of 60th Street in Manhattan:

Although the place of residence and the place of work were not tabulated by the Real Property Inventory, the Regional Plan report on "Transit and Transportation" containing estimates of the origin of persons entering Manhattan south of 59th Street on a typical business day in 1924, suggests that about 11 percent probably came from New Jersey; about 39 percent from Brooklyn, Queens and Long Island; some 48 percent from north Manhattan, The Bronx and Westchester; and 1.4 percent from Richmond. This study also indicates that *nearly one-half* of these people, including transients, entered Manhattan below 59th Street by *rapid transit* lines; also that transients combined with residents of lower Manhattan accounted for nearly one-third of the total Daytime Population.

If we disregard various factors, which, due to changed conditions would probably alter the 1924 figures, and apply these Regional Plan percentages to the 1934 "Working" Population, the total Daytime Population (including transients, school children and residents) of Manhattan south of 60th Street would total 1,885,000 persons of which some 940,000 may be assumed to have used rapid transit lines to reach their destinations. Since 1934 was a "depression year" and there was a larger proportion of persons residing in the city outside of the lower Manhattan area than in 1924, it might be expected that an even greater number of the 1934 working population came into Manhattan south of 60th Street via Rapid Transit than the 940,000 suggested above; and such seems to be the case as will be seen in this report.

RIDING HABIT

The riding habit of the population is an index to past and current trends in the use of transportation facilities, and it furnishes a basis for estimating the future traffic that may be expected from a given population. As employed in this report, the riding habit means the number of rides or paid fares per capita per year, and was ascertained from annual paid fares as reported by the New York Transit Commission, and the population figures for New York City as given in the Mayor's Committee Population Study.

Although transit traffic in New York City results from transients and commuters as well as residents, only the population of the city was considered in determining the riding habit. The traffic on the Hudson Tubes was omitted since this study was primarily concerned with the needs for transit service within the city that may be reflected in future capital expenditures.

Total fares per capita, both surface and rapid transit, increased steadily from about 45 in the year 1860 to 150 rides per capita in 1880, and continued with minor fluctuations to a peak of 460 rides in 1929. As shown by Figure 18, the recent depression is reflected in the drop of this riding habit curve during the period 1930-1937.

The data upon which this chart is based are available only for the years of the decennial Federal census prior to 1900, hence the opening of the first elevated railway in 1871 is not reflected until 1880. Since 1900 the rapid growth in riding habits has been mainly due to the rate of increase of fares per capita on rapid transit lines. While surface transit experienced a steady per capita growth prior to 1900, the riding habit curve has not shown a consistent tendency to increase since then.

Rapid transit traffic did not commence to exceed the volume on surface lines until 1917 when fares were about 185 per capita out of a total of some 350 fares on all facilities. Thereafter the rapid transit riding habit grew to a peak of 297 fares per capita in 1929, but declined during the depression and had returned to only 250 in 1937.

The total annual paid fares, shown on Figure 19, increased from 50 million in 1860 to more than 3 billion in 1930 and despite the depression drop, were again in excess of 3 billion in 1936 and 1937. Since 1925 when the ratio was about 61 percent, rapid transit carried a larger proportion of total traffic each year until 1933 when the ratio was 67 percent of total traffic.

Figure 19 shows all surface traffic without distinguishing between street car and motor bus riders. It is interesting to note, however, that during this same period the proportion of traffic carried by motor bus increased from 2.6 percent to about 6.6 percent, while surface car traffic dropped from 36.5 percent in 1925 to 26.7 percent in 1933. The recent extension of bus lines and the substitution of motor buses for surface cars is shown by the fact that 20 percent of total traffic was carried by buses in 1937. At the same time surface car volume fell from one-quarter in 1934 to 18 percent in 1937 and rapid transit traffic declined from 64 to 61 percent of total paid fares.

These data indicate that since 1933 the motor bus riding habit has expanded not only at the expense of surface cars but of rapid transit lines as well. In 1925, however, the total surface riding habit on motor buses and street cars stood at 176 fares per capita but was only 154 in 1937, and the ratio of surface traffic was practically the same for these two years, namely 39.1 percent of total traffic in 1925 and 38.1 percent in 1937.

TABLE 41
Monthly Fares of All Rapid Transit Lines
 (Data from Transit Commission Report—1936)

Month	Fares	Index	Month	Fares	Index
January	164,594,725	105.2	July	136,955,372	87.5
February	157,524,384	100.7	August	137,180,660	87.7
March	169,049,237	108.9	September	145,634,547	93.1
April	162,598,985	103.9	October	165,102,847	105.5
May	161,633,748	103.4	November	156,777,573	100.2
June	153,984,527	98.4	December	165,553,529	105.8

Future Riding Habits

The staff did not attempt to project the per capita curves for total nor for surface transit fares because of the variable factors involved. It would seem that, among other things, the comparatively short haul of most surface traffic will probably result in surface riding habits reaching a saturation point in the neighborhood of 170 fares per capita.

It might be contended that the rapid transit riding habit will be affected to some extent by the convenience of service offered in the future, and will relate to surface riding habits on this basis. If, however, the population distribution indicated by the Mayor's Committee staff study of the city's future pattern is accepted, and it is assumed that Manhattan will continue as the principal business center of the metropolitan area, with New York maintaining its present relative position in the country's economy, it must be recognized that the resulting demand for rapid transportation will produce increases in rapid transit traffic, provided that, the facilities necessary to meet such demands exist. The projection of the riding habit curve to 350 fares per capita in 1970, Figure 18, might be considered too conservative, but it was believed to be a reasonable basis for estimating future rapid transit traffic.

The annual traffic that would result from such a rapid transit riding habit, and the estimated population of New York City would reach 3.2 billion fares by the year 1970, as indicated in Figure 19. Obviously future economic conditions will cause annual variations from this curve, probably similar to past experience, but the traffic indicated for 1970 provides a means of measuring the need for rapid transit service which may be required in the future, assuming no fundamental change in the city's structure.

VARIATIONS IN TRAFFIC

It is a well known fact that transit traffic volume is subject to seasonal, daily and hourly variations.

A brief consideration of these phenomena will illustrate the extent of such variations and some of the factors to be dealt with in transportation studies.

Monthly Traffic

Although the extent of monthly variations is not necessarily the same from year to year, the relative divergence for each month is approximately the same. Hence the number of fares collected during each month of 1936 will serve as a general indication of the seasonal variation.

The average monthly traffic on all rapid transit lines was 156,382,511 during 1936; the column headed "Index" in Table 41 gives the ratio of change during each month from this average considered as 100. Starting at about 105 in January, traffic builds up to a peak of nearly 109 percent of average in March and thereafter declines to the summer lows, reaching 87.5 percent of average in July; by December traffic volume is about the same as in January. It should be noted that only the November volume equals the average; the February drop being more apparent than real, due to the shorter month.

Daily Traffic

While the "average daily traffic" approximated 5,579,000 for all rapid transit lines in 1936 (the 1936 annual total paid fares divided by 340 days), there was considerable variation as between the average daily and the maximum day on the various lines. The following tabulation reveals that the maximum day on some lines may reach 122 percent of the average daily traffic, but the maximum for all lines is 116 percent of the average.

The *average* daily 24 hour traffic tabulated above is based on 340 days. It is a figure commonly used for statistical purposes and furnishes a means of measuring traffic volume under "normal" conditions. This tabulation indicates that

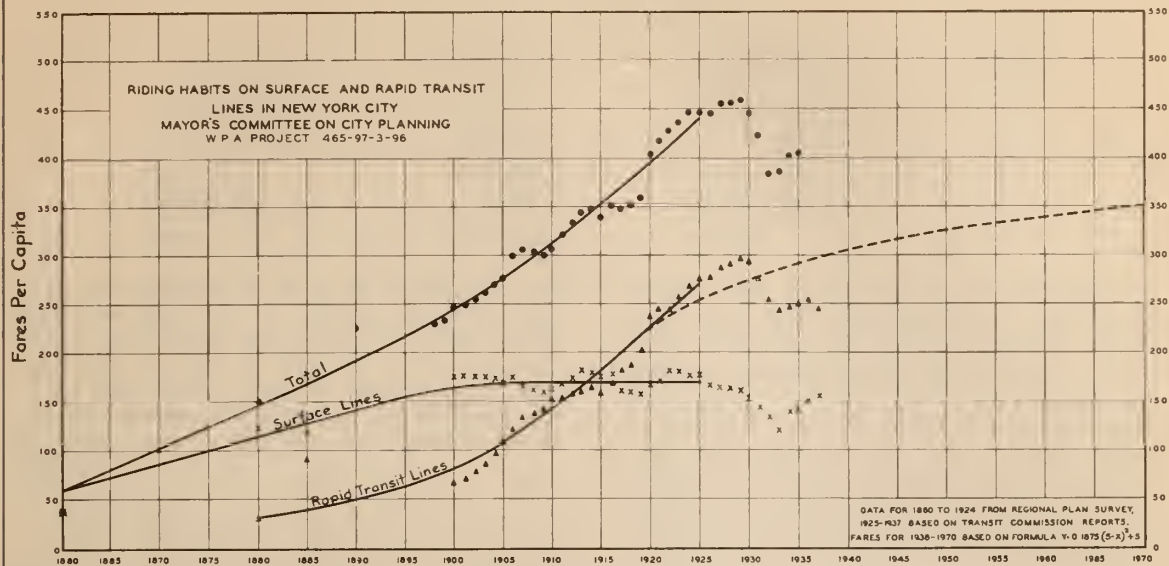


FIGURE 18

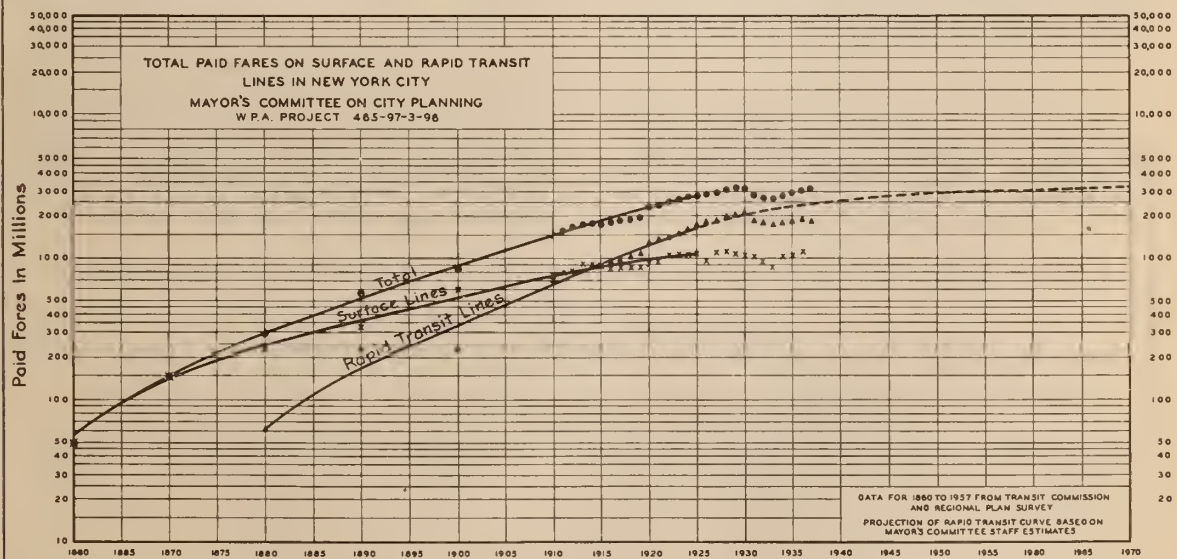


FIGURE 19

Daily Rapid Transit Traffic

Line	Average Daily Traffic	Maximum Daily Traffic	Ratio
I. R. T.—Subway	2,395,000	2,938,425 (Feb. 10)	122
I. R. T.—Elevated	632,000	680,574 (June 1)	107
B. M. T.	1,780,000	1,939,310 (Feb. 3)	109
Independent	772,000	952,362 (Dec. 21)	123
Total	5,579,000	6,510,671	116

with the exception of the I. R. T. Elevated, the maximum days for the various companies generally occur during the months of heavier travel. Although it might be desirable to use the maximum daily traffic volume to measure rapid transit service, this study employs the average daily as being more representative of "normal" operations.

Hourly Traffic

Figures obtained from the three operating companies showing the fare collections at all stations during each hour on typical days, reveal that in most cases the maximum traffic occurs between either 7 to 8 A. M. or 8 to 9 A. M. Inasmuch as these figures represent hourly traffic on even hours and cannot be analyzed for a 60-minute period that does not coincide with the hourly periods reported, it was decided to treat the "rush hour" periods as 7 to 9 A. M. and 5 to 7 P. M. This method makes it unnecessary to average fares for the maximum hour, and is believed to produce a fairly accurate picture of total "rush hour" traffic.

Table 42, summarizing the fares collected by each company, reveals that the 7-9 A. M. fares exceed the number collected during 5-7 P. M. on both the I. R. T. and the Independent systems. While the reverse condition rules for the B. M. T., the total morning rush on all lines exceeds the evening "rush hour" traffic volume. Consequently the 7-9 A. M. "rush hour" traffic was employed

in this study as representing the maximum demand upon rapid transit facilities. The average hourly collection was 270,595 fares; the average two-hour collection totaled 541,200 fares. Hence the morning "rush hour" volume is 2.6 times and the evening "rush hour" traffic 2.4 times the two-hour average traffic during a 24-hour day; and the combined morning and evening "rush hour" fares average 42.2 percent of all fares paid. It is interesting to note that the 7-9 A. M. traffic is equivalent to 66.5 percent of the 1934 "working" population of the city.

Maximum Peak Traffic—It should be pointed out that this 7-9 A. M. traffic is not spread equally over the two-hour period. There are shorter periods, which vary by line both as to the time of occurrence and duration, when the morning "rush hour" demand reaches peak proportions and produces maximum loads that are generally thirty percent, but in some cases seventy percent, greater than the normal 7-9 A. M. traffic. Although the two-hour volume furnishes a clue to the morning rush traffic, the bulges in this volume produce the peak loads that place the heaviest demands upon transit facilities.

TRAFFIC DISTRIBUTION

The distribution by boroughs of the ticket sales or fare collections at all of the rapid transit stations during the calendar year 1936 as reported by the Transit Commission is shown below.

TABLE 42
"Rush Hour"—24-Hour Traffic by Companies

Line	24-Hour	Morning Rush		Evening Rush		Date
		7-9 A. M.	% of 24-hr.	5-7 A. M.	% of 24-hr.	
I.R.T.	3,540,686	742,496	20.9	648,746	18.3	Dec. 1936
B.M.T.	2,007,516	455,286	22.7	464,270	23.2	Dec. 1936
Independent	946,014	226,786	23.9	201,839	21.3	Feb. 1937
Total	6,494,216	1,424,568	22.0	1,314,855	20.2	....

Traffic Distribution for the Year 1936

Borough	Annual Paid Fares in 1936	Percent of Total
Manhattan	1,059,086,566	55.8
Bronx	233,241,334	12.3
Brooklyn	463,139,639	24.4
Queens	132,941,408	7.0
Unallocated	9,695,438	0.5
Total	1,898,104,385	100.0

Since the "unallocated" item, including collections on B. M. T. trains, tickets sold at companies' offices for use on various lines, etc., represents a relatively small number of total fares, it may be ignored. More than one-half of all traffic originates in Manhattan, Bronx accounts for 12.3 percent, Brooklyn just under one-quarter, and Queens about 7 percent.

An analysis of the Transit Commission Report for 1936 reveals that about 784,259,000 fares, nearly three-quarters of all ticket sales in Manhattan, originated at stations south of 60th Street. While the fares collected at all stations in Manhattan north of 60th Street accounted for 14.5 percent of total rapid transit fares, the volume of traffic originating south of 60th Street in Manhattan was 41.3 percent of total rapid transit fares, or slightly less than the combined number of fares collected in the other three boroughs.

Origin of Rush Hour Traffic

A study of hourly ticket sales on typical days has shown that the maximum daily traffic occurs on most lines during the two-hour period 7 to 9 A. M. Table 43 shows all fares collected by each company on typical days and indicates the volume of traffic originating in the four boroughs during

the 7 to 9 A. M. "rush hour." The reports for the I. R. T. and B. M. T. cover a 24-hour period in December 1936, but the Independent figures were available only for a similar period in February 1937. The borough summaries are, therefore, not totals for a given day, nor are they directly comparable with "average daily" conditions. These figures, however, furnish a check on the results obtained in this study.

Since the "rush hour" traffic was moving in two directions at each station, Table 43 does not reveal destination, but it shows that of all fares collected during 7-9 A. M., 32 percent originated in Manhattan, one-fifth in The Bronx, almost 40 percent in Brooklyn, and only 11 percent in Queens. The I. R. T. accounted for more than one-half of the "rush hour" fares, the B. M. T. nearly one-third and the Independent about 16 percent.

Examination of the materials produced by a WPA project sponsored by the Transit Commission, reveals that the total fares collected 7-9 A. M. over a period of time approximate 26 percent of the average daily traffic. This ratio does not agree with the percentages given in Table 42 for typical days, but since it represents an average of annual operating conditions it may furnish a more representative ratio in estimating future traf-

TABLE 43
Origin of Rapid Transit Traffic 7-9 A. M.
(Based on Company Reports of Fares Collected on Dates Shown)

Borough	I.R.T. (Dec. 1936)	B.M.T. (Dec. 1936)	IND. (Feb. 1937)	Borough Total	% Borough of City Total
Manhattan	301,399	56,429	97,626	455,454	32.0
Bronx	233,809	....	52,349	286,158	20.1
Brooklyn	125,949	350,958	48,278	525,185	36.9
Queens	81,339	47,899	28,533	157,771	11.0
Total	742,496	455,286	226,786	1,424,568	100.0
Ratio to City Total	52.1%	32.0%	15.9%	100.0%	....

fic. Although fares collected indicate the origin of traffic, they do not reveal the destination of passengers nor the loads carried on a given line. Some passengers leave trains at most stations, even during the rush hours, and their number is not revealed by a tabulation of fares collected, despite the fact that a certain number of passengers were known to have entered the station on the uptown and the downtown platforms.

Since the rush hour traffic places the heaviest load upon transit facilities, the origin as well as the destination of this traffic must be considered in evaluating the adequacy of existing lines and in estimating future transportation needs.

One-way rush hour traffic volume determines the maximum service required to transport passengers to the work centers. In general the ratio of rush hour traffic to average daily and to yearly traffic on each line may be expected to remain practically constant. On this basis, and the supposition that there is no fundamental change in the pattern of the city, the rush hour traffic factor may be employed in estimating future rapid transit loads on the various lines.

Estimated 7-9 A. M. Traffic Entering Lower Manhattan—Average Week Day 1935

From Manhattan north of 60th Street	152,070	(15.5%)
From The Bronx	281,700	(28.7%)
From Brooklyn	426,560	(43.5%)
From Queens	120,170	(12.3%)
Total passengers entering Manhattan		
South of 60th Street	980,500	(100.0%)

The material prepared by the WPA project sponsored by the Transit Commission indicates that the 7-9 A. M. one-way traffic into that portion of Manhattan south of 60th Street was about 69 percent of the total 7 to 9 A. M. volume and was equivalent to 18 percent of the average daily traffic over a one-year period. After a careful evaluation of load diagrams and operating schedules produced by the above-mentioned project, the staff of the Mayor's Committee estimated the 7-9 A. M. volume of traffic on each line as it entered lower Manhattan. The figures on this page summarize this estimate by boroughs for an average week day during the year 1935.

This tabulation shows that only 15.5 percent of the "one way" passengers originate in Manhattan north of 60th Street, but reference to the figures in Table 44 will reveal that more than 300,000 additional fares (over one-fifth of all collections during 7-9 A. M.) are paid in Manhattan. Since the majority of these 300,000 fares are doubtless due

to the movements of railroad commuters, transients and residents of lower Manhattan (rather than to traffic from upper Manhattan moving away from the business district to The Bronx), it may be assumed that most of this traffic originates south of 60th Street. Such estimates do not have the same degree of accuracy as reports of actual fares paid, but they provide a basis for estimating the volume of rapid transit traffic moving into the business center.

The Working Population (excluding transients, school children, etc.) located in Manhattan south of 60th Street is over 1,250,000 persons according to the 1934 Real Property Inventory. A superficial comparison would suggest that more than three-quarters of this Working Population used transit facilities in going from place of residence to working centers in lower Manhattan. However, on the basis of ratios used by the Regional Plan in 1924 this Real Property Inventory Working Population figure indicates that the *total* Daytime Population of lower Manhattan is at least 1,885,000 including business men not having offices in lower Manhattan, transients, shoppers, school children,

etc. Hence it is unlikely that more than 52 percent of the *total* Daytime Population of lower Manhattan enters this area by rapid transit during 7-9 A. M.

Present Rush Hour Traffic

Before discussing future traffic and line capacities, it will be of interest to summarize the estimates of present "rush hour" and average daily traffic. Table 44 shows that of the average daily fares, well over one-half originate in Manhattan, due no doubt to the business, commercial, shopping and transient travel volume within the borough, as well as to the daily return of workers in the evening to their homes in other boroughs. Approximately 15 percent of the average daily traffic in Manhattan is accounted for during the morning "rush hour," but only one-third of this volume originates in Manhattan north of 60th Street.

The average daily fares paid in *The Bronx* ac-

count for about 12 percent of the city total, but 43 percent of these collections are made during the morning "rush hour" and it is estimated that 98 percent of this traffic moves into lower Manhattan.

About one-quarter of the daily traffic originates in *Brooklyn*, of which 40 percent is "rush hour" and of this 7-9 A. M. traffic it is estimated that over 80 percent is destined for lower Manhattan. In addition to traffic originating in Brooklyn during 7-9 A. M., there are over 32,000 passengers from Queens that pass through Brooklyn on B. M. T. trains en route to lower Manhattan.

While only 7 percent of the average daily fares are paid in *Queens*, about the same proportions are "rush hour" as in The Bronx. It seems that only three-quarters of these 7-9 A. M. passengers from Queens enter Manhattan below 60th Street. Of the 120,170 passengers bound for lower Manhattan during 7-9 A. M., about 27 percent use B. M. T. trains routed through Brooklyn.

Employing the annual paid fares estimated for the year 1970 (Figure 19) the average daily figure would be 9,500,000 on the basis of 340 days; and using a "rush hour" ratio of 26.3 percent, the 7-9 A. M. traffic would be 2,500,000. If the present one-way ratio held, the morning rush hour traffic into lower Manhattan would average 1,710,000 passengers daily. However, Table 44 shows that the proportion of morning traffic, to the average daily traffic originating in each borough that moves into lower Manhattan, varies as between the boroughs. This general estimate is unsatisfactory not only because of the varying ratios of one-way traffic on the several lines, but also because of expected population shifts and different borough riding habits. While we may expect the total 7-9 A. M. traffic ratio to hold, the one-way "rush hour" relationships are almost certain to be modified by changing conditions. The 1970 population distribution, as envisaged in the Residential Area Study, would change the relative 1935 positions of the

several boroughs in respect to resident population and, in order to estimate the origin and destination of rush hour traffic, it is necessary to consider borough riding habits as well as probable concentrations of employment.

Future Rush Hour Traffic

This study does not attempt to determine the optimum distribution or concentration of commercial functions in New York. However, the professional, service, finance and retail activities of the metropolitan area are centered in Manhattan, as well as extensive manufacturing and shipping of certain kinds. It seems likely, therefore, that Manhattan will continue to attract those activities requiring central locations, conveniently accessible to the greatest number of persons. Some decentralization is unquestionably desirable and will inevitably result from technological advances and intelligent planning. Short of unpredictable or cataclysmic economic forces, however, it would seem that the tremendous investments in private activities and in public services centered in lower Manhattan, as well as the established position of such activities, will tend to keep Manhattan in a commanding position.

One of the purposes of this study was to discover whether this condition can continue unchanged. Hence, in order to ascertain what transit conditions would be, unless present trends are modified, the staff assumed that the morning "rush hour" traffic on an average day in 1970 would increase over the present volume in the same proportion as the population and riding habits on each line. The 1934 population in the zone extending one-half mile on either side of each line was obtained and employed to determine present riding habits on each line. The 1970 population in the area served by each line was obtained from the Residential Area Study estimates; the present rush

TABLE 44
Average Daily and 7-9 A. M. Rapid Transit Traffic
(Estimate for 1935)

Borough	Average Daily		7-9 A. M. All Traffic		7-9 A. M. One-Way		Ratio One-Way to All
	Total	%	Total	% A. D.	To Lower Manhattan	% A.D.	
Manhattan	3,050,000	56.3	455,454	14.9	152,070	5.0	33.4
Bronx	665,000	12.3	286,158	43.0	281,700	42.3	98.1
Brooklyn	1,330,000	24.5	525,185	39.5	426,560	32.0	81.0
Queens	375,000	6.9	157,771	42.0	120,170	32.0	76.1
Total	5,420,000	100.0	1,424,568	26.3	980,500	18.1	68.8

TABLE 45
Origin of Estimated Rush Hour Traffic
Into Lower Manhattan

Borough	1935 Traffic		1970 Traffic		Ratio 1970 to 1935
	Total	%	Total	%	
Manhattan north of 60th St.	152,070	15.5	208,500	11.5	1.35
Bronx	281,700	28.7	470,500	26.0	1.67
Brooklyn	426,560	43.5	787,000	43.6	1.84
Queens	120,170	12.3	342,000	18.9	2.84
Total	980,500	100.0	1,808,000	100.0	1.84

hour traffic at stations on all lines was available from records of the Transit Commission WPA project. The 7-9 A. M. traffic into Manhattan south of 60th Street, calculated separately for each line, would exceed 1,800,000 passengers for the year 1970. See Table 45.

Origin of Future "Rush Hour" Traffic Into Lower Manhattan

This estimate is summarized by borough of origin and compared with the 1935 figures in Table 45. It indicates that, with the exception of Brooklyn, the proportion of "rush hour" traffic entering lower Manhattan would vary from the present ratios for each borough, because of expected shifts in population distribution and increased riding habits.

On the basis of present tendencies of the 7-9 A. M. passengers, it is estimated that about 16 percent (contrasted with 27 percent in 1935) of the Queens traffic will pass through Brooklyn and enter lower Manhattan over the B. M. T. lines. Hence of the 342,000 "rush hour" passengers indicated by Table 45 as originating in Queens, about 53,400 are expected to follow present routings over the B. M. T. through Brooklyn to reach lower Manhattan. The total resulting traffic entering Manhattan on lines from Brooklyn would then ex-

ceed 840,000, and the traffic entering Manhattan directly from Queens would be under 290,000. This routing has an important bearing on the estimates of needed facilities that are discussed later in this report.

If all 7-9 A. M. traffic continues at the present ratio to average daily, the fares collected on an average day in the year 1970 during this two-hour morning period would total 2,500,000 (which figure is 1.7 times the 1935 collections). The 1,808,000 estimated passengers into lower Manhattan would then approximate 72 percent of all 7-9 A. M. traffic (compared with 69 percent in 1935) and would be 1.8 times the 1935 "one-way" volume.

As may be seen from the tabulation on this page, the difference between total fares collected 7-9 A. M. and the traffic entering lower Manhattan would leave a balance of nearly 700,000 fares unaccounted for by this estimate. This figure is about 1.5 times the 444,068 passengers that did not enter lower Manhattan during 7-9 A. M. in 1935. If, however, it is assumed that this same ratio of increase (1.5) will apply for traffic originating in Manhattan mostly below 60th Street, there would be approximately 475,000 fares collected in this area.

The staff estimates that in 1935 there were some 140,000 rush hour passengers from The Bronx,

Estimate of Average Daily One-Way Traffic 7-9 A. M.

	1935	1970
Total 7-9 A. M. Traffic.....	1,424,568	2,500,000
Into Lower Manhattan.....	980,500	1,808,000
Balance of Total.....	444,068	692,000
Fares originating in Manhattan mostly below 60th Street.....	303,384	475,000
Fares originating in other Boroughs not destined for Manhattan.....	140,684	217,000

TABLE 46
Rapid Transit Car Capacities
(Information from Transit Commission)

Line and Car Type	Seats Per Car	"Reasonable" Load		"Maximum" Load	
		Persons Standing	Total Load	Persons Standing	Total Load
B.M.T. Subway A-B	78	117	195	220	298
B.M.T. Subway D	156	234	390	440	596
I.R.T. Subway	44	66	110	160	204
I.R.T. Elevated	50	38	88	100	150
Independent	60	90	150	234	294

Brooklyn and Queens that were not destined for lower Manhattan; the above tabulation indicates that this figure would be 217,000 in 1970, or about 1.5 times the present figure.

PRESENT CAPACITY

In estimating the 7-9 A. M. capacity of rapid transit lines into Manhattan south of 60th Street, the staff employed "reasonable" carloadings as defined by the Transit Commission, reported train lengths and 1935 operating schedules on each line. Although capacity is relative, depending upon the number of cars per train and operating headways between trains as well as the degree of carloadings, it was assumed that most lines of the I. R. T. and B. M. T. were running at maximum schedule under 1935 conditions. On some lines, the Independent in particular, it appears that longer trains can be operated at more frequent intervals, but a stepping-up in schedule on the I. R. T. and B. M. T. would generally require additional equipment and enlarged station facilities.

The I. R. T. Elevated lines in Manhattan are not operating at capacity due mainly to the falling demand of the riding public for such service. In 1921 these lines accounted for one-quarter of the total rapid transit traffic. While the volume of rapid transit traffic increased each year after 1921, the traffic carried by the Manhattan Elevated declined steadily to only 11.5 percent of the total by 1936. Throughout this period, however, the 6th Avenue Elevated continued to carry about one-third of all elevated traffic in Manhattan. Obviously the I. R. T. Elevated facilities have in the past and could now handle a larger traffic volume, but the staff assumed that present operating conditions represent capacity schedule inasmuch as it appears unlikely that the declining riding habit trend will be reversed.

At the time of this study (1936) there were so

few data available on the operation of the Independent system that the staff estimated capacity on the basis of ten-car trains operating on a 2-minute headway over the routes shown on Figure 17. Each delivery of new cars, on order or provided for in the Capital Outlay Budget, will increase the capacity of that portion of the system under operation and the potential of the sections under construction.

The Transit Commission rating of "reasonable" and "maximum" capacity of the various types of rapid transit cars now in service on the lines of each company is shown by the figures in Table 46. The "maximum" load, allowing in the neighborhood of 1.3 square feet of floor space per standing passenger, is not unusual on some lines during peak operation, but such overcrowding produces indecent travel conditions. The "reasonable" load, based on about 3 square feet per standing passenger, does not represent the most desirable nor convenient transportation, but the staff selected this rating as a practical basis in determining line capacity.

Rush Hour Capacity

The estimated capacity of the lines from each borough into lower Manhattan is given in Table 47 and compared with the estimated 7-9 A. M. loads. The loads from Brooklyn and Queens are based upon the routes followed and hence do not agree with the figures given in Table 45 which includes the estimated origin of traffic on lines including those starting in Queens but passing through Brooklyn.

Demolition of the 6th Avenue "El", commenced since this study was made, has reduced the estimated capacity of the I. R. T. Elevated as given in Table 47 by about 24,200 passengers.

It should be pointed out that the entire rated capacity of the Independent system, which in-

PRESENT RAPID TRANSIT LOAD DIAGRAM

MAY - 1935

THE AVERAGE WEEK DAY ONE-WAY RUSH HOUR LOAD SHOWN AS A PERCENT
OF NORMAL CAPACITY FOR EACH LINE ENTERING MANHATTAN BASED UPON
DATA FROM THE BOARD OF TRANSPORTATION AND THE TRANSIT COMMISSION

LEGEND

LESS THAN 100 PERCENT OF CAPACITY
MORE THAN 100 PERCENT OF CAPACITY
SCALE NORMAL CAPACITY OR 100 PERCENT

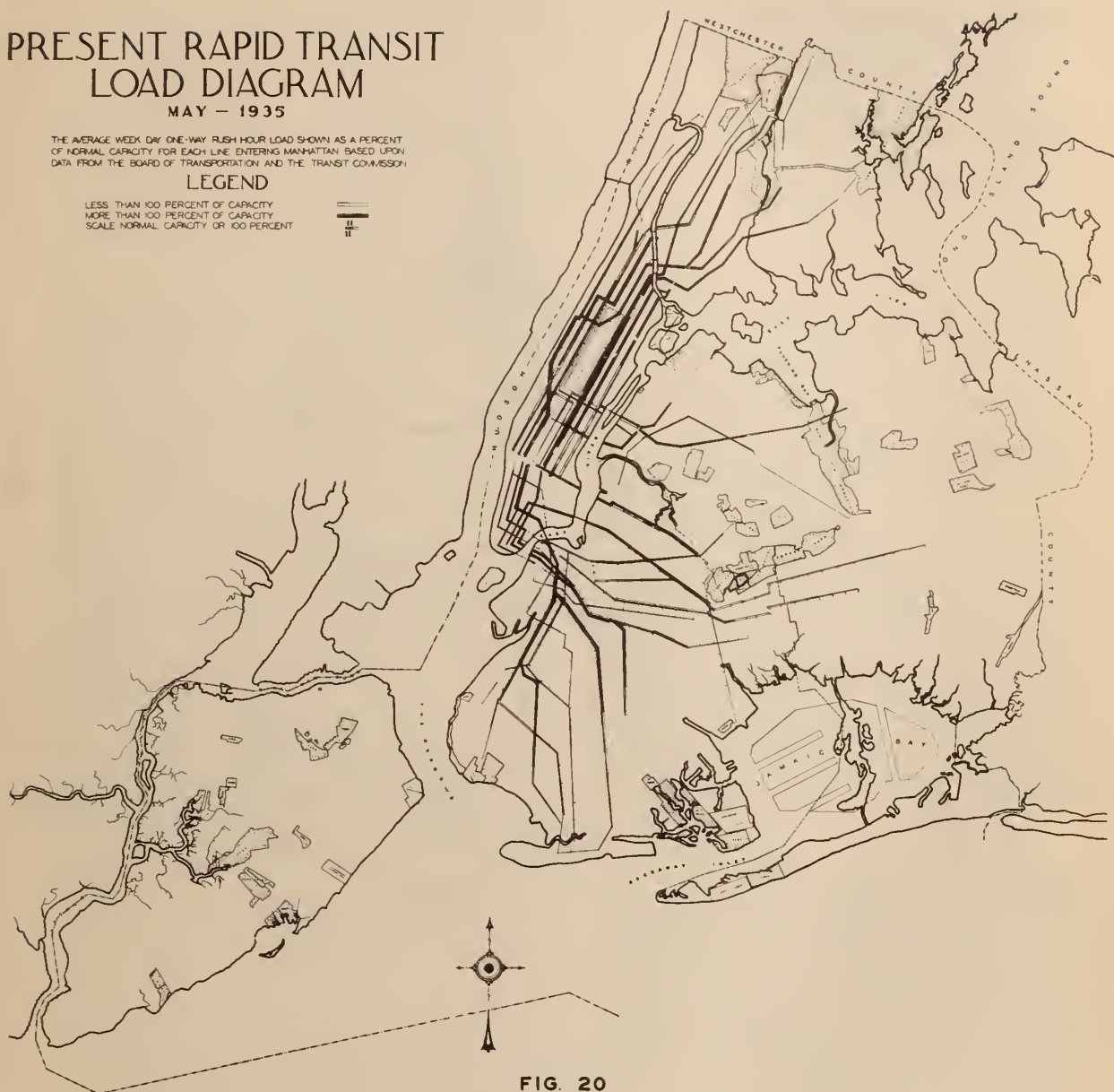


FIG. 20

ULTIMATE RAPID TRANSIT LOAD DIAGRAM

YEAR — 1970

THE AVERAGE WEEK DAY ONE WAY RUSH HOUR LOAD SHOWN AS A PERCENT OF NOMINAL CAPACITY FOR EACH LINE ENTERING MANHATTAN ASSUMING THE ESTIMATED ULTIMATE POPULATION TRAVEL ON EXISTING RAPID TRANSIT LINES AT MAXIMUM OPERATION

LEGEND

LESS THAN 100 PERCENT OF CAPACITY
MORE THAN 100 PERCENT OF CAPACITY
SCALE: NOMINAL CAPACITY OR 100 PERCENT

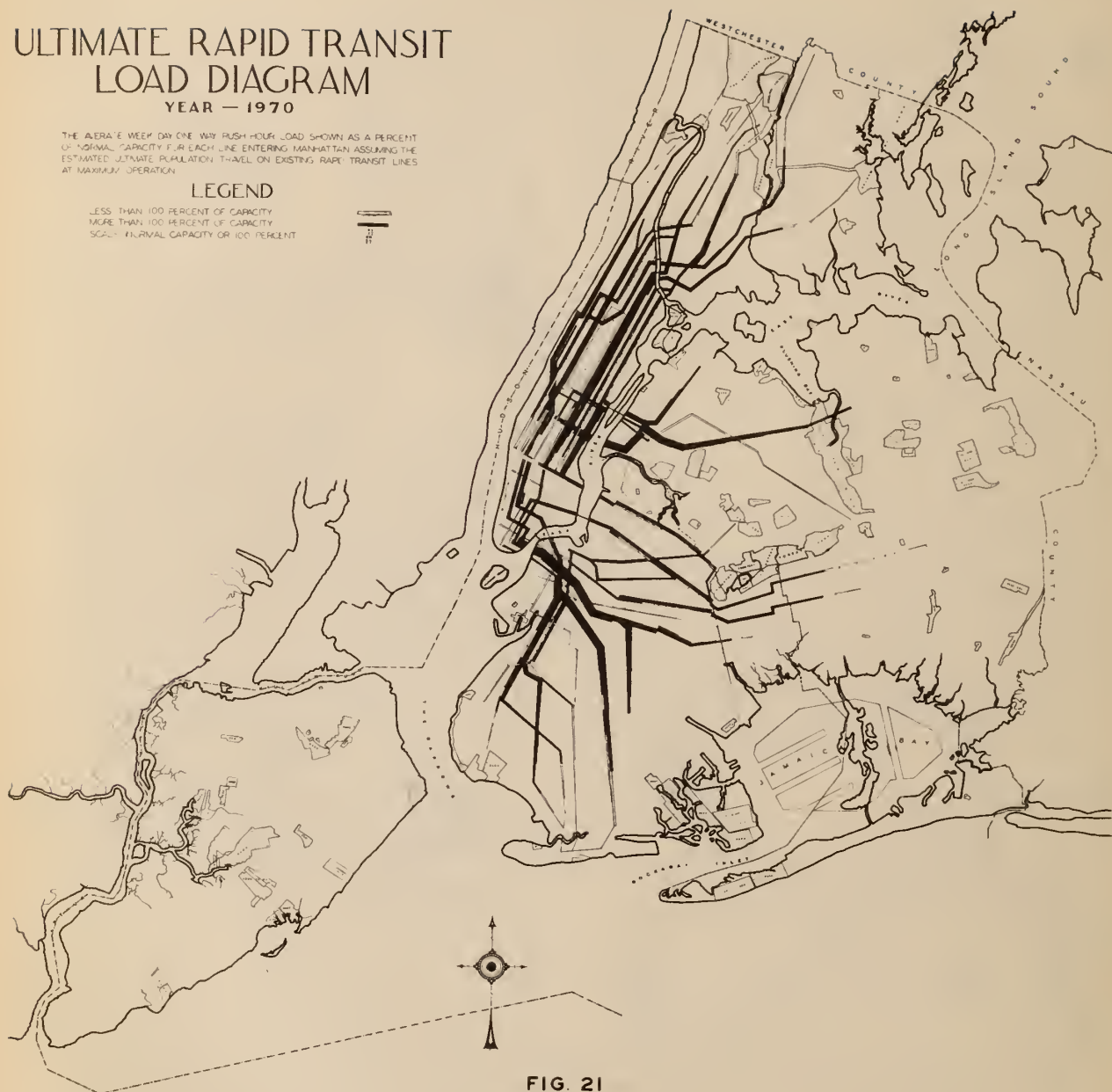


FIG. 21

TABLE 47
Estimated Present 7-9 A. M. Capacity
 (Based on 1935 Schedules of the B. M. T. and I. R. T. and Assumed Operation of the Independent)

Line	From Bronx and North Manhattan	From Brooklyn	From Queens	Total
B.M.T. Subway	....	330,400	68,400	398,800
I.R.T. Elevated	105,600	....	11,300	116,900
I.R.T. Subway	211,800	138,600	28,000	378,400
Independent	180,000	180,000	90,000	450,000
Total	497,400	649,000	197,700	1,344,100
1935 Load	433,770	459,150	87,580	980,500
Ratio to Capacity	87%	70%	44%	73%

cludes sections of lines under construction, was not actually available in 1935. Consequently the full extent of overloads during the periods of peak demand in 1935 on the I. R. T. and B. M. T. are not revealed by the figures in Table 47, but are indicated diagrammatically by Figure 20. While the 7-9 A. M. traffic volume furnishes a clue to the rapid transit services needed, the maximum peak loads must be considered in measuring the adequacy of existing lines and determining the requirements for new lines.

Capacity Under Peak Loads

Table 47 suggests that the combined facilities are carrying an average load of 73 percent of the rated capacity available for this two-hour period. However, the maximum loads carried by trains on most lines during the half hour or more of peak demand are considerably above the 7-9 A. M. average. An inspection of Figure 20, showing the maximum peak loads expressed as percent of capacity of trains operating on each line under 1935 schedules, will reveal that most lines are taxed to more than 100 percent of capacity before reaching lower Manhattan. This peak load averages 1.3 times the normal 7-9 A. M. traffic for all lines, but reaches 1.6 times capacity on some trains from Brooklyn, 1.9 times the capacity of one line from The Bronx and upper Manhattan, and exceeds the capacity of one Queens line by 1.5 times.

Figure 20 indicates that in Brooklyn the heaviest loads are carried to the downtown business district of this borough, and therefore a measure of loads into Manhattan does not accurately reflect the capacity demands in Brooklyn.

An analysis of load diagrams (produced by the Transit Commission WPA project) indicates that on the average the 7-9 A. M. loads carried

on Brooklyn trains, that do not originate in Queens and are routed through the Brooklyn business center, exceed the volume of traffic from Brooklyn into lower Manhattan by about 10 percent. This would indicate that Brooklyn, unlike The Bronx, Queens and northern Manhattan, has such a concentration of workers (about 17 percent of the City's "Working" Population) that more transit capacity is needed within the borough than is required to transport workers from Brooklyn to lower Manhattan.

Technical limitations made it impossible to indicate on Figure 20 the loads on south bound trains below 14th Street in Manhattan nor on north bound trains above this point, but in general traffic volume dwindles to relatively small proportions by the time trains reach 14th Street. Although large numbers of passengers leave south bound subways at or above these stations, Figure 20 shows that the influx of transients and residents of lower Manhattan, as well as of railroad commuters at the Pennsylvania and Grand Central stations keep these lines well loaded below these points.

Future Peak Loads

Before discussing the estimates of rapid transit facilities that would be required to meet the 1970 traffic demand under the assumptions employed, it will be of interest to examine the effect of such traffic upon the 1935 rated capacity of existing rapid transit lines as given in Table 47. Employing the same assumptions that were used to ascertain the total 7-9 A. M. traffic volume into lower Manhattan in 1970, the staff estimated the maximum peak loads that will probably result on each line. See Figure 21. This estimated traffic when compared with the 1935 rated capacity indicates that on this basis practically every line, with the

exception of the Independent, would be required to operate above 150 percent of capacity within a short distance of its starting point, and sections of lines in Manhattan from 180 up to 400 percent of capacity. These theoretical loads are wholly impossible on existing facilities. Figure 20 shows that serious traffic congestion already exists in Manhattan and at the convergence of lines leading from The Bronx, Queens and Brooklyn to Manhattan. This analysis suggests not only the magnitude of the problem but also the impracticability of the city providing adequate transit for an ultimate population of 9.2 millions, if continuance of a comparable proportion of working population in lower Manhattan is assumed.

FACILITIES NEEDED BY THE YEAR 1970

This study shows that the maximum peak loads, during the morning rush hour into lower Manhattan, average 1.3 times the normal 7-9 A. M. traffic volume. Assuming that this phenomenon will continue, the capacity necessary to carry maximum peak rush hour loads on all lines would average 1.3 times the capacity of facilities needed for the normal 7-9 A. M. traffic volume.

Improving Existing Facilities

New rapid transit lines, at an average cost of \$4,000,000 per track mile, are quite an expensive utility. Therefore, the staff examined the possibility of increasing the capacity of the present system through relatively less costly "remedial measures" (i. e., measures to eliminate present bottlenecks and other conditions limiting the capacity of existing facilities) prior to determining the extent of additional facilities that will be needed to carry the maximum peak loads. Although "capacity" is a variable term, in this study carloadings are made a constant on the basis of "reasonable" capacity as defined by the Transit Commission. (If the basis for carloading is taken as one standing passenger for each person seated, the "reasonable" load shown in Table 46 would be reduced by one-fifth on subway cars.) With carloadings fixed, the remaining variables are number of cars per train and headway between trains. "Remedial measures," therefore, involve improvements to existing facilities that would permit the operation of more trains at reduced headways, and in some cases with additional cars, to obtain the greater capacity required to handle maximum peak loads.

Since the Manhattan Elevated lines are losing passengers and are becoming uneconomic utilities, it was assumed that they will not be in service by

the year 1970. Demolition of the 6th Avenue "EI" indicates the trend. With the Fulton Street line of the Independent system in operation, it is also supposed that the Fulton Street Elevated line of the B. M. T. in Brooklyn will be eliminated and the tracks removed from the Brooklyn Bridge.

From an inspection of operating conditions, it appears that both a reduction in headway and longer trains can be obtained on most lines of the B. M. T. and the entire Independent system, provided that the necessary rolling stock is available and that "turn-arounds" are speeded up on the B. M. T. in Manhattan. On the I. R. T. subway, however, it would be necessary to reconstruct many stations and to purchase additional equipment in order to step-up service during periods of maximum peak loads.

B. M. T. remedial measures involve the elimination of crossovers north of the 57th Street station, at the Chambers or Canal Street stations, and on the 14th Street line in Manhattan, to permit a faster turn around of trains on these lines; and the elimination of a crossover at De Kalb Avenue, Brooklyn. Without these measures it is now possible to operate trains into Manhattan on a 2-minute headway provided, of course, that sufficient rolling stock is available. On the basis of 8-car trains of the A and B type operated on a 2-minute headway, the potential 7-9 A. M. capacity of the B. M. T. from Brooklyn would be 468,000 passengers (an increase of 158,000 over the 1935 schedule after subtracting the capacity of the Brooklyn Bridge line) and from Queens 70,200 passengers (an increase of 1,800 over the 1935 schedule). See Table 48. If, however, 10-car trains of the A and B type (equivalent in capacity to 5 sections of the D type triple unit) were operated on a 2-minute headway, the potential 7-9 A. M. capacity from Brooklyn could be increased to 585,000 and from Queens to 87,700 passengers.

Although new cars may be needed to operate longer trains on a 2-minute headway, the staff analysis summarized in Table 48 shows that the B. M. T. lines if more fully utilized in the future can provide an increase in normal 7-9 A. M. service.

I. R. T. remedial measures include the lengthening of local subway platforms to accommodate ten-car trains; reconstruction of about eleven express stations to increase the number of tracks and platforms, and by the elimination of crossovers to permit two express trains headed in the same direction to stop simultaneously at these now congested stations; and the station reconstruction necessary for the operation of express trains on

TABLE 48
Normal 7-9 A. M. Capacity of Existing Lines and Potential Capacity with Remedial Measures
(Excluding Manhattan Elevated and Brooklyn Bridge Lines)

Line	From Bronx and North Manhattan in the years:		From Brooklyn in the years:		From Queens in the years:	
	1935	1970	1935	1970	1935	1970
I.R.T.	211,800	260,700	138,600	138,600	28,000	61,000
B. M. T.	.....	.....	310,000	468,000	68,400	70,200
Independent	180,000	180,000	180,000	180,000	90,000	90,000
Total	391,800	440,700	628,600	786,600	186,400	221,200

the third track of the Queensboro subway. (This track was used for storage prior to the opening of the World's Fair, but is now accommodating express trains.)

Costs of Remedial Measures—In a Regional Plan study, suggesting the first two of the I. R. T. remedial measures, the cost estimates indicate that the construction and equipment outlined above could be done for \$76,250,000. In the case of the B. M. T., the staff estimated costs at \$8,750,000 for construction and equipment. The probable financing of this work is discussed in another section of this report.

Table 48 compares the 1935 rated capacity with the estimated normal capacity that would be available during 7-9 A. M. if present lines were fully utilized through remedial measures. This estimate is believed to be reasonably conservative but it indicates some interesting possibilities. On the I. R. T. the lengthening of local platforms and the running of ten-car local trains on 1935 schedules would add about 48,000 to the capacity of the I. R. T. lines from The Bronx and northern Manhattan. On the Queensboro line, express service at the rate of 30 trains of ten cars each during 7-9 A. M. would add 33,000 to the present capacity of this line. (In 1935, 30 local trains were operated during 7-9 A. M. through the Queensboro tunnel, so that 30 additional express trains would reduce tunnel headway to 2 minutes.) No increase is assumed in the normal 7-9 A. M. operation of the East and West Side I. R. T. express trains from Brooklyn.

The B. M. T. potential capacity (based on 8-car trains of the A and B type operated on 2-minute headways) would be materially increased from Brooklyn, but the Queens service is limited by the number of southbound local trains (not only from Queens but on the Essex Street loop) that can be operated through the Montague Street

tunnel on the return trip to Brooklyn.

Since the rated capacity of the Independent is based on the operation of ten-car trains on a 2-minute headway there would be no increase in normal 7-9 A. M. capacity, assuming of course that sufficient equipment were available.

Analyses indicate that remedial measures, including necessary new cars, will not only make it possible to obtain the potential capacity shown in Table 48 for normal operation during 7-9 A. M., but that they will permit the stepping-up of this normal service by 1.3 times to take care of the average maximum peak loads. For example, the normal rated capacity of the Independent is based on ten-car trains operated on a 2-minute headway; if 40 trains per hour of ten cars each were operated (on a 1½-minute headway) the rated capacity would be increased by 1.33 times. Or as an alternate during the period of maximum peak load, it would be possible to run thirteen-car trains on a 2-minute headway, which would provide 1.3 times the present rated capacity.

New Lines

Thus the completion of remedial measures and the provision of the necessary equipment would not only increase the normal 7-9 A. M. rated capacity by fully utilizing existing lines but, according to this study, would, by operating more trains, also make it possible to step up schedules sufficiently to accommodate maximum peak loads. In determining the capacity of new lines required by the estimated normal 7-9 A. M. traffic in 1970, the potential normal capacity that would result from remedial measures was assumed to be available.

In ascertaining the number of new lines needed to provide the full capacity required under 1970 loads, the staff employed the Independent type of line and car as the norm. Assuming ten-car trains

operated on a 2-minute headway, the normal 7-9 A. M. capacity of a 2-track subway would be 90,000 passengers in one direction, and full service, (i. e., 40 trains per hour on a 1½-minute headway) can attain 1.33 times the normal to handle maximum peak rush hour loads.

From The Bronx the rush load is estimated at 470,500 passengers in 1970 (Table 45) and the potential capacity of present facilities, excluding the Manhattan Elevated lines, at 376,900 during 7-9 A. M. Hence new lines of 93,600 capacity are indicated.

From Manhattan north of 60th Street the 1970 load is calculated at 208,500 passengers and the potential capacity of subway lines that do not enter The Bronx at 63,800 passengers, revealing the need for new lines of 144,700 capacity. Since the 7-9 A. M. one-way capacity of a 2-track subway is 90,000 passengers, two such lines will be required to handle this traffic. But only 93,600 new capacity is needed from The Bronx so that 86,400 of the new capacity would be available to traffic from Manhattan north of 60th Street and, as shown in the tabulation on this page, only one new 2-track line would be needed to serve Manhattan.

business district in 1970. Since, however, the potential capacity of B. M. T. and Independent lines within Brooklyn (that serve outlying areas and passing through the business district but do not enter Manhattan) is estimated at more than 200,000 passengers, no new lines are indicated for this traffic.

With the potential capacity of lines entering Manhattan via the Brooklyn business center estimated at nearly 600,000 passengers, about 80,000 additional capacity will be required by the 1970 traffic. This need can be met by one new 2-track line of the Independent type, which with a capacity of 90,000 would provide an excess of 10,000 over needs and to that extent reduce overcrowding.

The 1970 rush hour traffic to Manhattan over the Canarsie-14th Street line and the Williamsburg Bridge line (which do not traverse the Brooklyn business center) is estimated at 161,300 including about 53,400 passengers from Queens. Under remedial measures the potential capacity of these lines will be 187,000 passengers during 7-9 A. M. and therefore, no new facilities are needed to handle the 1970 traffic.

Estimated Capacity Needed in 1970 From The Bronx and Manhattan North of 60th Street

	From The Bronx	From Manhattan	Total
Capacity of new lines	180,000	90,000	270,000
Additional capacity needed	93,600	144,700	238,300
Balance available	86,400	54,700	31,700

Even on this basis there would be a balance available of 31,700 surplus capacity, over and above the 1970 loads from The Bronx and northern Manhattan, which would permit more latitude in operation or somewhat less crowding during periods of maximum peak loads.

From Brooklyn the total traffic entering Manhattan during 7-9 A. M. in 1970 is estimated at 840,400 passengers, including some 53,400 passengers from Queens. Of this total about 680,000 persons are expected to come from South and East Brooklyn and, on the basis of present routings, pass through the business district of this borough enroute to Manhattan.

As previously mentioned, the 1935 traffic to the Brooklyn business center along with Manhattan bound traffic produced loads in the Brooklyn business district that exceeded the loads on trains entering Manhattan by 10 percent. Assuming a continuance of this tendency, it is estimated that nearly 70,000 passengers will travel to the Brooklyn

From Queens the total rush hour load is estimated at 342,000 passengers by 1970. On the basis of current trends this study assumes that some 53,400 of these passengers will utilize the B. M. T. lines running through Brooklyn to enter Manhattan at or below 14th Street. On this basis the balance of 288,600 passengers would enter Manhattan direct from Queens. The potential normal capacity of existing lines, available through remedial measures, is estimated at 221,200 passengers during 7-9 A. M. Therefore, new facilities with a normal capacity of 67,400 passengers are indicated; and this need can be met by the construction of one new 2-track subway with a normal 7-9 A. M. capacity of 90,000 passengers. The provision of such a line would leave an excess capacity of 22,600 passengers which would reduce the amount of crowding during 7-9 A. M. to that extent.

No specific route studies for these new lines were undertaken, but it seems that at least 225 miles of

single track would be required for main lines and feeders. At an assumed cost of \$4,000,000 per mile for construction, equipment, yards, power plants, etc., these new lines would require outlays of at least \$900,000,000 before the year 1970. Even assuming that any such amount could be provided, the question arises as to whether the life of the city might not be so reorganized as to make these outlays unnecessary. For present purposes, however, this estimate is useful as a gauge of the cost of continuing recent trends.

UNIFICATION

Besides new lines, there are other transit items that must be considered in connection with the master plan and capital program. One of these items is the unification, or acquisition by the city, of the I. R. T. and B. M. T. and the joint operation of all rapid transit by a public agency. It is not possible in this report to review the history of rapid transit operation in New York. It is pertinent, however, to recall the fact that the city paid for part of the construction, and in some instances, equipment for the I. R. T. and B. M. T. subways. The operating companies paid the balance and contracted to provide transportation service on these systems. It is believed that unification will make possible a single coordinated system, with unified control and better service to the public, but this study did not attempt to determine the resulting operating costs or economies.

It is unlikely that private agencies can be induced to finance the construction of new lines. Private capital was not able to do so in the past; hence the building of new lines must be treated as a public enterprise. If the city should own the entire transit system as a result of unification it might be possible to reduce the costs of new lines proposed in this study. This could be done by utilizing existing routes of the B. M. T. in downtown Manhattan and thus save at least \$100,000,000 of the \$900,000,000 estimated as necessary to build the new lines needed by 1970. In arriving at the costs of remedial measures, however, the staff assumed that the operating companies would furnish the additional rolling stock required. Under unification the city would have to finance remedial measures and the cost of this new equipment as well. Staff analyses indicate that these new cars will add about \$50,000,000 to the estimated costs of remedial measures previously discussed in this report. Therefore, on the basis of this study there would be a net saving of approximately \$50,000,000 on the estimated costs of new lines and remedial measures under unification.

The costs of unification have been variously estimated at \$429,500,000 —tentative price fixed by a Transit Commission study in 1924; \$436,157,000 — Seabury-Berle Plan; \$320,000,000 — tentative price as reported in the New York Times of May 13, 1938. A constitutional amendment permitting the city to issue up to \$315,000,000 of bonds, exempt from the ten percent debt limit, for the purchase of rapid transit was approved by the electorate in the fall of 1938.

For the purposes of this study, it is assumed that the acquisition of the I. R. T. and B. M. T. properties will cost about \$315,000,000 (or the exchange of an equivalent amount of city obligations). In addition, the staff estimates that approximately \$85,000,000 will be required to effect physical transfers, inter-connections, and for necessary equipment and contingencies, that will be needed to provide the improved service that may be generally expected after unification.

Unification is desirable from the long term viewpoint, not only because of the improved service possible through unified operation and the greater ease of carrying out remedial measures, but also because a city-owned system can be coordinated with, and needed new lines can be more readily integrated in, a comprehensive plan for city development.

LINES UNDER CONSTRUCTION

In preceding sections of the report it was assumed that the potential normal operation of the Independent system, as shown by Figure 17, would be available in 1970. Consequently, with the exception of the Sixth Avenue line of the Independent system (which is needed to handle traffic in Manhattan), none of the lines under construction or authorized in the 1937 Capital Outlay Budget increase the "rated" passenger capacity (as defined herein) of lines into Manhattan south of 60th Street. Extensions of the Concourse line, the Fulton Street and Culver lines in Brooklyn, or of the Queens line, will obviously make the Independent service available to a greater number of people, but will not increase the rated capacity of these lines to bring more people into lower Manhattan.

The convergence of the collecting and distributing branches of the various lines from each borough at the relatively few tracks in tunnel or bridge crossings into lower Manhattan limits the capacity of each line to the number of Manhattan bound trains that can be operated over the tracks available at such crossings. For example, the proposed Concourse line extension will bring transit service

to a larger area of The Bronx, but the number of "rush hour" passengers that this line can bring into lower Manhattan from The Bronx is limited to the number of trains that can be operated through the 155th Street tunnel as well as to the combined number of trains originating in Manhattan and The Bronx that can travel over the two southbound tracks in Manhattan below 145th Street. This study was, therefore, concerned with the costs of completing lines under construction or authorized, and the need for proposed extensions of lines shown on Figure 17.

The Mayor's Committee Finance Study assumed (1) that authorizations for projects contained in the 1937 and prior Capital Outlay Budgets would be financed to the full extent of appropriations contained in these budgets, and (2) that bonds of equivalent amount would be issued. On this basis only the balance of appropriations required to complete such projects would need to be contained in future capital budgets.

The lines under construction or authorized in the 1937 Capital Outlay Budget and the additional appropriations required to complete these projects are shown on this page.

project of first priority, especially since the several studies of the Mayor's Committee indicate needs for other equally urgent public services, the costs of which materially exceed the city's expected ability to finance such improvements. Inasmuch as the required new lines from Brooklyn are predicated upon the eventual removal of the Fulton Street Elevated and the B. M. T. tracks on the Brooklyn Bridge, the staff acknowledged the desirability of extending the Fulton Street subway at some time prior to 1970. However, additional funds have since been made available and contracts let for sections of the subway construction so that a discussion of the place of this extension in a long-term program is academic. The balance of appropriations necessary to complete the Fulton Street line to Grant Avenue should be included in the proposed transit program.

At the time of writing (January 1939) construction has not yet commenced on the Concourse or Culver line extensions. Until a city-wide plan for transit has been related to a comprehensive master plan, the staff believes that these two extensions should be deferred. They will not increase the rated capacity of lines into work centers, and it

Lines Under Construction or Authorized in the 1937 Capital Outlay Budget

Sixth Avenue	\$ 18,120,000
Concourse extension to Kingsland Avenue	10,680,000
Fulton Street extension to Grant Avenue	55,600,000
Culver connection with B.M.T. (excludes recapture)	10,179,000
Other specific authorizations including station equipment, yards, shops, cars and facilities for lines under operation	10,000,000
Total additional appropriations required to complete	<u>\$104,579,000</u>

Although the Rockaway line (carried in the 1937 but omitted from the 1938 Capital Outlay Budget) is not included in the above tabulation, outlays aggregating more than 104 million dollars will be needed to complete these projects already authorized.

Like other elements of the master plan that influence the direction of the city's development, transit should be examined from a city-wide point of view with particular reference to a coordinated system. It is from such an approach that the staff has attempted to evaluate the above projects.

In order to obtain the potential rated capacity of the Independent as used in this study, it will be necessary to complete the 6th Avenue line. It is questionable that the Fulton Street extension (which will practically duplicate an existing transit line in Brooklyn) can be demonstrated to be a

may develop that a coordinated plan for rapid transit construction and operation will provide better service to the same outlying areas through other lines and thus render these particular extensions unnecessary.

As nearly as can be determined, the items listed under "Other Specific Authorizations" are projects necessary to the operation of the subway systems. They can probably be completed with additional appropriations of about \$10,000,000 above the amounts already authorized.

DEPRECIATION

In addition to remedial measures, new lines, unification and lines under construction or authorized, consideration should be given to the depreciation and contingent type of project which could not be

dealt with individually in this study. Such needs would presumably be financed as capital projects rather than as items replaceable through maintenance. These projects include the replacement of worn-out equipment and structures, and such unforeseen needs as construction of new power plants or additional facilities that may be required for lines in operation.

Depreciation Rates

Since the staff could not undertake investigations that would indicate the probable extent of such needs over the next thirty years, these items were determined on the basis of a depreciation factor. Income statements contained in a 1936 report of the Transit Commission show that the I. R. T. reserve for depreciation is equivalent to about 0.29 percent of the company's investment; and in the case of the B. M. T., 0.45 percent. The Board of Transportation report for the fiscal year ending June 30, 1938 contains a tentative figure for depreciation of the structures and equipment of the railroad which is 0.17 percent of the total investment in the Independent system.

The statements in the Transit Commission report do not enumerate the particular facilities covered by the I. R. T. and B. M. T. depreciation reserves. It would seem unlikely, however, that these funds are being reserved for the obsolescence of that portion of these lines constructed by the city. It may be assumed that these company reserves provide only for depreciation of equipment purchased by the I. R. T. and B. M. T. and, therefore, are not as inclusive as the Independent depreciation reserve. No generating plants have been built in connection with the Independent Subway since power for the operation of this system is purchased; but power plant depreciation is undoubtedly included in the I. R. T. and B. M. T. reserve. The selection of a depreciation factor is further complicated by the fact that different elements of a rapid transit railroad have varying rates of obsolescence. For example, tunnels generally do not wear out as fast as elevated structures. Reference to the "Proceedings of the Transit Construction Commissioner of 1920" suggests that whereas power plants obsolesce in less than 25 years, some equipment may be expected to serve for 35 years, and certain types of elevated structures for more than 50 years.

Lack of time did not permit a study of separate depreciation rates for each type of structure and equipment. Under the circumstances it was believed that an average of the depreciation rates employed by the I. R. T., B. M. T. and Independent would represent a reasonable allowance for

obsolescence and contingencies if applied to the total investment in these railroads. Although this average is only 0.3 percent yearly, many items are replaced through maintenance, payable from operating revenues.

Investment in Rapid Transit

Figures from the Transit Commission and the Board of Transportation indicate that as of June 30, 1936, the city's investment in rapid transit exceeded \$1,000,000,000 apportioned approximately as follows:

I. R. T.	\$186,627,000
B. M. T.	207,945,000
Independent	<u>696,944,000</u>
	\$1,091,516,000

The Mayor's Committee on City Planning Finance Study estimates that the financing of authorizations contained in the 1937 Capital Outlay Budget will bring the city's investment to more than \$1,103,000,000. In addition to amounts spent by the city, the I. R. T. and B. M. T. companies have invested over \$500,000,000 for construction and equipment. The total investment in rapid transit, therefore, approximates \$1,600,000,000.

The main objective of this study was the determination of needs under the conditions assumed and the scheduling of projects to meet these requirements over three 6-year periods. Staff estimates of the amounts needed for depreciation are based on the city's investment as of the beginning of each 6-year period. This is a deferred depreciation allowance insofar as projects completed within a 6-year period are concerned. But the amounts increase each six years in accordance with the amount of authorizations suggested for new projects, and it was believed a practical method for this study.

At the beginning of the first 6-year period (1939 to 1944 inclusive) the city's investment was taken as \$1,103,360,000. There is usually a considerable lag between budget authorizations and actual expenditures during any year. While over \$60,000,000 of capital funds were authorized for transit in November 1936, only slightly more than \$35,000,000 was actually spent for transit projects during the entire year. This figure excludes contract liability. Consequently it was assumed that \$1,103,360,000 would represent the city's investment at the end of 1938.

During the 6-year period 1939 to 1944 the following suppositions would add \$678,720,000 to

the city's investment: (1) that unification will be effected at a cost of \$400,000,000; (2) that remedial measures should be carried out by the end of 1956, which at an aggregate cost of \$135,000,000 for constructions, equipment and new cars would require \$45,000,000 during each 6-year period; (3) that lines under construction or authorized will be completed to the extent of \$83,720,000 (see Table 49); and (4) that at least \$150,000,000 should be expended on new lines, so that the necessary additional service will be available by the year 1970. Thus at the beginning of the second 6-year period (1945 to 1950 inclusive), the city's investment would aggregate \$1,782,080,000.

During the six years, 1945 to 1950, the following expenditures would increase the city's investment by \$195,000,000 to a total of \$1,977,080,000 at the beginning of the year 1951: remedial measures \$45,000,000 and new lines \$150,000,000.

Allowance for Depreciation

On the basis of a 0.3 percent rate an average of almost \$3,320,000 of capital funds would be needed each year to cover depreciation and contingencies on the city's investment of \$1,103,360,000 in transit.

For the first 6-year period, 1939 to 1944 inclusive, therefore, the allowance would aggregate \$19,850,000 assuming that no reserve were set up on any additional investments in new construction and equipment that may be financed during this period.

For the second 6-year period, 1945 to 1950 inclusive, the allowance would be \$32,000,000 at a rate of 0.3 percent per year on the assumed investment of \$1,782,080,000.

For the third 6-year period, 1951 to 1956 inclusive, \$35,600,000 would be required for depreciation and contingencies on the investment of \$1,977,080,000 assumed at the beginning of the year 1951. See Table 49.

COST OF INDICATED TRANSIT IMPROVEMENTS

The costs of rapid transit projects indicated by this study are summarized in Table 49 according to the three 6-year periods employed in the Finance Study. Remedial measures should be undertaken immediately to relieve overcrowding on the I. R. T. and to permit full utilization of the potential capacity of existing facilities. But in order to coordinate these improvements with new lines, it seems preferable to schedule expenditures equally over the three 6-year periods.

Under unification there will be no saving on I. R. T. remedial measures but the routing of new lines and their connection with the B. M. T. in Manhattan may make certain of these improvements unnecessary. Since the savings are problematical, Table 49 shows eighteen-year expenditures aggregating \$135,000,000 (I. R. T. @ \$76,250,000; B. M. T. @ \$8,750,000; and new rolling stock @ \$50,000,000).

With unification, new lines that will be needed by 1970 are estimated to cost \$800,000,000 and, if expenditures are spread about equally over thirty-two years, only \$150,000,000 would be scheduled during each 6-year period. At this rate of construction, the entire system of new lines could be operating by the year 1970.

Inasmuch as unification now seems assured, it is assumed that expenditures of \$400,000,000, or

TABLE 49
Schedule of Expenditures for Indicated Transit Improvements
(Figures in Millions of Dollars)

Project	1939-44	1945-50	1951-56	18-Year Total
Remedial measures	45.00	45.00	45.00	135.00
New lines	150.00	150.00	150.00	450.00
Unification	400.00	....	....	400.00
Total new projects	595.00	195.00	195.00	985.00
Pending projects	83.72	....	....	83.72
Sub-total	678.72	195.00	195.00	1,068.72
Depreciation	19.85	32.00	35.60	87.45
Totals	698.57	227.00	230.60	1,156.17

an equivalent bond issue, will be necessary at some time prior to 1945. This outlay is supposed to cover purchase of the I. R. T. and B. M. T. as well as improvements to effect transfers, interconnections and contingencies. Table 49 lists expenditures for new projects (remedial measures, new lines and unification) of 595 million dollars the first six years, and of 195 million dollars for the second and third periods.

Under "pending projects" the schedule (Table 49) calls for outlays of \$83,720,000 during 1939-44 to complete the following projects to which the city is partially committed through authorizations in the 1938 Capital Outlay Budget: 6th Avenue line—18.12 million dollars; Fulton Street extension to Grant Avenue—55.6 million dollars; and other specific authorizations including station equipment, yards, shops, cars and facilities for lines under operation—10 million dollars.

Items not otherwise provided for in this study would be included under "Depreciation," excluding that portion of the rapid transit system replaceable through maintenance. Table 49 schedules expenditures of 19.85 million dollars for these items during the first 6-year period; 32 million dollars for the second; and 35.6 million dollars for the 6-year period ending with 1956.

On the basis of this analysis expenditures aggregating \$1,156,170,000 are called for during the next eighteen years; 698.57 million dollars during the six years 1939-1944, 227 million dollars in the second 6-year period, and 230.6 million dollars over the third period.

If the expenditures summarized in Table 49 are made during the next eighteen years, the city's investment in rapid transit would approximate two and one-quarter billion dollars in the year 1957, which figure is equivalent to 6.15 percent of the 36.4 billion dollars national debt as of the fiscal year 1937. Although not all of this tremendous in-

vestment would be represented by outstanding debt in the year 1956, it is of interest to compare transit indebtedness to other term obligations of New York City.

Rapid Transit Debt

Analyses made by the staff in the course of the Finance Study reveal that of the 2,046.4 millions of corporate stock and serial bonds issued for permanent improvements and outstanding December 31, 1937, thirty-seven percent or 757.06 millions of dollars represented investments in rapid transit. The last of these transit obligations will not mature until the fiscal year ending June 30, 1983, and will require about 1.11 million dollars for debt service at that time.

Table 50 indicates the amounts of these obligations estimated to be outstanding at several periods up to 1956 and the debt service thereon, but these figures do not include new term debt issued since December 31, 1937. The longer term of transit obligations is reflected in the relative increase of the amounts outstanding and the debt service, which reach 45.3 and 40.4 percent respectively of the totals by June 30, 1956; in 1970 about 482 million of this transit debt (73.2 percent of the total of these transit bonds) will still be outstanding and will require 24.5 million dollars for debt service.

The staff did not attempt to determine the probable proportions of total future debt that may be due to rapid transit. But the figures in Table 50 are indicative of the large debt service costs on account of transit in relation to other improvements for which obligations were issued in the past.

Future Expenditures and Resources

The Finance Study revealed that the city's resources would probably permit expenditures of 2,032.78 million dollars during the eighteen years

TABLE 50
Rapid Transit Debt & All Term Debt
Outstanding as of December 31, 1937
(Figures in Millions of Dollars)

Date	Outstanding Debt			Estimated Debt Service		
	Total	Transit	%	Total	Transit	%
12/31/38	2,013.3	752.7	37.4	118.5	38.0	32.1
6/30/42	1,890.4	745.1	39.4	108.3	37.8	34.9
6/30/47	1,804.1	733.2	40.6	100.4	37.4	37.5
6/30/52	1,716.4	700.3	40.8	96.2	36.4	38.0
6/30/56	1,464.0	664.0	45.3	86.4	34.8	40.4

ending in 1956 for capital projects. However, the reservation of 168.24 million dollars as a debt cushion was recommended, which would leave 1,864.54 million dollars of capital outlays for all purposes.

During the thirteen years 1924-36, rapid transit improvements accounted for about 45 percent of all capital expenditures. The transit expenditures shown in Table 49 would, if made as capital outlays, account for 62 percent of the city's indicated resources, and there would remain only a little more than 700 million to cover capital outlays for all other improvements, including water supply, schools, etc.

It is not the purpose of this study to formulate a capital program including the several types of permanent improvements. However, the extent of future outlays indicated for transit in relation to the city's probable capacity to finance such projects, and the relatively large debt service charges on prior transit improvements, suggest the magnitude of the problem and the impracticability of a solution along traditional lines. How is the city to obtain desirable transit facilities and at the same time those many other public improvements needed to correct present deficiencies and to provide adequate services in the future? All of the public improvements indicated as desirable by the several Mayor's Committee Studies cannot be financed within the next eighteen years unless the city's resources as forecast in the Finance Study are enlarged by additional revenue from present sources, or by increased income from the subway system or other sources.

The Master Plan and Transit

A self-sustaining transit system, or one partially subsidized, operated by a public authority may solve the financial problems of transit operation and capital improvements. Further consideration of rapid transit schedules in the eighteen-year program may be found in the "Program for Permanent Improvements," Volume III of this series of reports.

This study is predicated upon the population distribution that would result from the residential pattern indicated by the Residential Area study, and the continuance of a large proportion of the working population in lower Manhattan. In effect

it reveals the impracticability of providing the transit required by such a pattern of development. A master plan embodying a different pattern of population distribution and altered relationships between residential and working centers would obviously produce somewhat different transit "needs" based upon the requirements for transit service dictated by such plan.

Even if urban population continues to increase, it appears unlikely that the city can attain an ultimate population of 9.2 millions unless it faces the need for large expenditures upon additional rapid transit facilities. The extent to which new feeder lines, or extensions of present lines, would add to the congestion of lines already taxed to capacity as compared to the relief that might be afforded by alternate routes, presumably embodying more circumferential links, should be carefully investigated in order to determine the desirability and practicability of such lines as have been proposed.

It is apparent that the capacity of existing lines can be increased by various remedial measures to relieve bottle-necks in the present system. Additional crosstown lines, which would provide alternate traffic routings and encourage the diffusion of development, should be given consideration. It is also patent that expenditures for transit as well as for other permanent improvements will be limited by the city's indicated financial resources. Therefore, only the more urgent projects should be included in a balanced outlay program, and duplication of existing services should be avoided.

New York is indeed fortunate that under the New Charter, city planning has become a permanent function of municipal government. The City Planning Commission will be able to give careful, unbiased consideration to the city's future development and to guide its growth in an orderly manner. This study suggests that rapid transit is such a potent force in determining the direction of growth that it may be employed to guide desirable development.

If the city is to conserve its financial resources and at the same time further the social and economic life of its inhabitants through the provision of necessary public services, it is essential that rapid transit and other permanent improvements be coordinated with a comprehensive Master Plan for city development.

Other Public Services

INTRODUCTION

Special city-wide studies of Highways, Water Supply, Sanitation, Parks, Schools, and Rapid Transit, discussed in preceding chapters of this volume, include suggested programs in which expenditures are scheduled to meet the indicated needs for these permanent improvements. These improvements have accounted for the bulk of past municipal expenditures but there are many other public works and services of equal importance to the well-being of the city's inhabitants.

In order to complete the studies of all desirable permanent improvements that must be considered in future capital programs, it was necessary to in-

clude these "Other Public Services." In this chapter these remaining items are grouped under "Docks," "Protection," "Health," and "Public Buildings and Miscellaneous."

Unfortunately, limitations of time and resources precluded investigations of Other Public Services comparable in method with the six major studies enumerated above. Consequently the staff was forced to employ more general but reasonably satisfactory procedures in ascertaining the probable expenditures that may be required to provide adequate facilities for Docks, Protection, Health, and Public Buildings and Miscellaneous. ⁽¹⁵⁾

Docks

This section of the report considers water and airport facilities, including dockage, bulkheading, ferries and ferry slips. While the importance of water borne commerce in the economy of New York and its environs is obvious, it is of interest to note the position of the port relative to the commerce of the United States as a whole.

WATER COMMERCE

The commercial facilities of the Port of New York continue to handle about one-tenth of the tonnage and better than 30 percent of the value of the nation's gross foreign and coastwise trade. Of the foreign trade alone, more than one-fifth of the tonnage and well over one-half of the value passes through New York Harbor. Table 51 shows that foreign trade has fallen off proportionately less in the Port of New York than in all United States ocean ports, and further, that this port continues to handle a fairly constant percentage of the nation's coastwise commerce. Table 51 does not include any commerce designated as internal, intraport or local traffic by the Board of Army Engineers.

While the figures are not given in Table 51, imports at the Port of New York have averaged about one-half and exports 36 percent of the total value of United States foreign trade since 1923. (See Progress Report of the Mayor's Committee on City Planning, June, 1936.)

As a further indication of the importance of trade, the United States census reports show that since 1890 more than one-quarter of the persons employed in New York City alone (excluding the other cities within the Port of New York) were engaged in transportation, trade and communication. In the year 1930 more than 850,000 persons of the 3,187,459 total then gainfully employed were reported as occupied in one of these three categories. Although the entire 850,000 were not *directly* connected with water commerce in 1930, it is reasonable to suppose that the employment of a majority of these persons depended upon port activity.

Port Facilities

There are roughly 190 miles of dockage and wharfage available to accommodate the foreign, coastwise, intraport, and local water commerce at the Port of New York. Of the total waterfront facilities about 110 miles or 56 percent lie within New York City, and nearly 85 miles or 44 percent are in New Jersey.

As revealed in Table 52, the municipality owns only 28.3 miles or 26 percent of the waterfront facilities within New York City; private interests control about 70 percent and the Federal and State governments the balance of the waterfront. Analyses of Comptroller's reports indicate that \$226,000,000 has been invested by the city in properties under the jurisdiction of the Dock Department, including docks, piers and bulkheads (this figure is exclusive of ferries and airports).

(15) This study was completed and the original report drafted in January, 1939.

TABLE 51

Commerce of New York Harbor and of the Entire United States
In Millions of Tons and Millions of Dollars

(From Annual Reports of the U. S. Board of Engineers for Rivers and Harbors)

YEAR	TERMINAL	FOREIGN				COASTWISE				FOREIGN AND COASTWISE			
		TONS		VALUE		TONS		VALUE		TONS		VALUES	
		Total	%	Total	%	Total	%	Total	%	Total	%	Total	%
1925	New York United States	27.87 108.54	25.7	4,846.7 9,257.9	52.4	37.51 433.31	8.7	3,330.4 16,233.4	20.5	65.38 541.86	12.1	8,177.2 25,491.4	32.1
1926	New York United States	28.14 131.29	21.4	4,486.9 8,941.9	50.2	33.86 449.01	7.5	2,370.6 14,471.5	16.4	62.01 580.31	10.7	6,857.6 23,413.5	29.3
1927	New York United States	28.83 120.52	23.9	4,542.7 9,001.2	50.5	45.97 469.88	9.8	3,117.4 15,560.0	20.0	74.80 590.40	12.7	7,660.1 24,561.3	31.2
1928	New York United States	30.66 126.76	24.2	5,070.2 9,731.4	52.1	39.03 477.10	8.2	2,590.5 15,164.5	17.1	69.70 768.98	9.1	7,660.8 24,895.9	30.8
1929	New York United States	30.49 127.51	23.9	4,355.4 8,920.7	48.8	42.66 521.67	8.2	2,437.2 15,697.3	15.5	73.16 649.18	11.3	6,792.6 24,618.0	27.6
1930	New York United States	26.62 114.10	23.3	3,925.7 7,513.2	52.3	38.96 455.22	8.6	2,413.5 13,396.6	18.0	65.58 569.33	11.5	6,339.2 20,909.8	30.3
1931	New York United States	21.67 89.52	24.2	3,167.1 5,391.7	58.7	36.12 371.47	9.7	1,805.5 10,408.4	17.3	57.79 460.99	12.5	4,972.7 15,800.2	31.5
1932	New York United States	17.63 70.42	25.0	2,105.3 3,628.7	58.0	30.49 267.95	11.4	1,546.9 7,890.4	19.6	48.12 338.38	14.2	3,652.3 11,519.1	31.7
1933	New York United States	15.98 69.46	23.0	2,445.8 4,137.8	59.1	32.15 359.17	9.0	1,372.3 9,410.8	14.6	48.14 428.63	11.2	3,818.2 13,548.7	28.2
1934	New York United States	17.89 46.89	38.2	3,575.7 5,571.2	64.2	35.51 370.06	9.6	1,913.0 10,231.9	18.7	53.40 416.96	12.8	5,488.7 15,803.1	34.7
1935	New York United States	17.45 81.63	21.4	4,580.3 6,821.0	67.1	33.39 399.17	8.4	2,117.7 11,582.2	18.3	50.86 480.81	10.6	6,698.0 18,403.2	36.4
1936	New York United States	19.40 90.24	21.5	4,070.8 6,483.7	62.8	36.16 496.20	7.3	2,186.5 13,641.9	16.0	55.56 586.54	9.5	6,257.4 20,125.7	31.1

Figures for New York Harbor include Port Chester, Mamaroneck, Milton, Echo Bay, New Rochelle, East Chester Creek, Westchester Creek, Bronx River, Manhasset Bay, Flushing Bay, Harlem River, Lower Hudson, New York-New Jersey Hudson Channel, Newtown Creek, Wallabout Channel, Buttermilk Channel, Bay Ridge and Red Hook, Gowanus Creek, Gravesend Bay, Coney Island Creek, Sheepshead Bay, Jamaica Bay, City Island,

Shoal Harbor and Compton Creek, Lemon Creek, Keyport Harbor, Washington Channel and South River, Woodbridge Creek, Elizabeth River, Upper Bay, Sandy Hook Bay, New York-New Jersey Channel (not Hudson), Rahway River, Newark Bay, Hackensack River, Passaic River, Great Kills (in some years), Cheesapeake Creek, Swinburne-Hoffman-Staton Island Channel, Matawan Creek, and Raritan River to Arthur Kill.

TABLE 52
Ownership of Waterfront of New York Harbor in Miles Measured Along Shore
(From Port Series 20, 1932, Army Engineers)

OWNERSHIP	NEW YORK CITY		NEW JERSEY	
	Miles	Percent	Miles	Percent
Federal Government	2.44	2.24	1.69	2.01
State Governments	2.45	2.25	0.96	1.14
Municipal	28.31	26.00	3.62	4.30
Private	75.70	69.51	77.96	92.55
Total	108.90	100.00	84.23	100.00

In 1938 these properties were assessed at approximately \$294,000,000; omitting land, the assessed value of improvements was more than \$72,750,000.

The figures in Table 52 show that the city is responsible for a minor portion of the waterfront facilities, although its investment in docks is considerable. Reference to Table 51 will reveal that nearly 75 million tons of foreign and coastwise commerce were handled at the Port of New York in 1927, which is equivalent to about 390,000 tons per mile of facility; in 1936 the comparative figure was only 287,000 tons per mile. While these figures are not conclusive they do show that in general there is no need for expanding port facilities, at least until the volume of water commerce materially exceeds the present and surpasses the 1925 tonnage.

On the other hand there is a tendency to rebuild certain portions of the waterfront to provide the wider slips and longer piers needed to accommodate the larger vessels now operating in overseas service. There is also some change in use of the waterfront as evidenced in the reclamation program now going forward in connection with marginal highways and park developments, and the operation of the foreign trade zone in Staten Island. These and other factors tend to increase the obsolescence of the older dockage, particularly along the Hudson River, and thus make the modernization of dock facilities more desirable.

Future Outlays for Piers, Slips, etc.

The foregoing suggests that replacements and improvements to existing city-owned facilities to take care of obsolescence will require most, if not all, of the capital expenditures for docks during the next eighteen years.

Under the new charter, dock improvements may be financed by bonds with a maturity not exceeding fifty years. If the major part of future dock

expenditures are required for replacement, this charter provision suggests a fifty-year depreciation allowance as normally sufficient for piers, slips, wharfs, etc. A more reasonable allowance, however, would permit replacements on the basis of twenty-five or thirty-year obsolescence. Accordingly the obsolescence rate was fixed at 3.5 percent per year on the capital investment, which might also be expected to take care of contingencies. Since land does not depreciate, the obsolescence factor need be applied only to the investment in dock improvements. The allowance for docks by six-year periods are included with "bulkheads" in the following section.

Bulkheading

The Department of Docks is responsible for bulkheading in connection with marginal streets, wharfs, piers, etc. This Department is also called upon to construct bulkheads for the protection of parks, highways, bridges, and other public property adjacent to water. In the several Mayor's Committee Studies, however, staff estimates of expenditures include the costs of bulkheading whenever such work is incidental to a project. Consequently the only expenditures for bulkheads that need be considered here are for dock, pier, and wharf improvements.

The 72.5 million dollars assessed value includes bulkheading as well as dockage under the jurisdiction of the Dock Department and, since future needs for dockage seem to be mainly for replacements, the same condition may be assumed to apply to bulkheading. On this basis the staff estimates the capital outlays that will probably be needed for bulkheading at the rate of 3.5 percent on the assessed value.

Future Outlays for Dockage and Bulkheading

Assuming that an annual expenditure equivalent to 3.5 percent on the assessed value of dock and

bulkhead improvements will take care of future needs, the staff estimated that about \$15,450,000 of capital funds will be required during each of the three 6-year periods, or a total of \$46,350,000 over the next eighteen years.

The program suggested above does not provide for the proposed bulkheading of Jamaica Bay since the disposition of this great area is still undecided. This proposal calls for an investment of about \$25,000,000 in bulkheading alone. Inasmuch as existing port facilities seem more than adequate for the volume of water commerce handled at the Port, there is no apparent need for additional dockage. In any case the burden of proof rests with the proponents of the proposed development of Jamaica Bay. At this time there seems to be no justification for such a costly improvement within the next eighteen years.

AIRPORTS

The growth of air commerce calls for adequate airfields conveniently accessible to the center of the city. New York has developed a splendid airport at Floyd Bennett Field in Brooklyn with modern facilities which have led experts to class this airport as one of the few super-terminals in the country.

North Beach Airport in Queens is now being extensively developed to handle both land and seaplanes. Upon completion of present plans, this airport will have the facilities needed for continental and trans-oceanic operations.

In addition to these major airports, the city maintains seaplane landing stations on the East River at Wall Street, and at 31st Street. It is planned to provide another East River ramp for seaplanes at 23rd Street and by means of an aerial ferry service thus to bring Floyd Bennett Field within a few minutes of business centers in Manhattan.

Investments in Airports

The following tabulation shows the city's original investment in these airports as well as the amounts that are expected to be expended by the city and the WPA for improvements now under way. Although the entire program will not be completed by 1939, the staff used the \$21,482,000

<i>Airport</i>	<i>Original Costs</i>	<i>City and WPA</i>	<i>Total</i>
Floyd Bennett Field	\$4,000,000	\$3,000,000	\$7,000,000
North Beach	1,500,000	12,762,000	14,262,000
Seaplane Bases . . . . .	....	220,000	220,000
Totals	\$5,500,000	\$15,982,000	\$21,482,000

total as the cost of airport facilities as of 1938. ⁽¹⁶⁾

Lacking time to develop quantitative or qualitative methods of measurement, the staff estimated future needs on the basis of this investment in airports. Air transport is making rapid strides not only in commerce handled but in technical improvements. Hence it may be supposed that airport facilities will obsolesce at a faster rate than other types of permanent improvements.

Future Airport Outlays

The use of an obsolescence factor does not imply the need for complete replacement of facilities but is presumed to allow for such improvements as may be necessary to keep pace with future technical developments and operating practices, as well as for desirable expansion of airports.

Because of the relatively rapid changes to be expected in the future, outlays for the first 6-year period were determined on the basis of 5 percent per year on the total capital investment; for the second 6-year period a rate of 6 percent was employed; and 7 percent was used for the third period. This cumulative increase in the depreciation rate is believed to be a conservative "factor of safety" in estimating capital outlays for airport facilities, it will probably cover contingencies as well as depreciation due to future improvements. On this basis, about \$6,450,000 would be needed during the first 6-year period, \$7,750,000 for the second, and \$9,000,000 during the third period; or a total of 23.2 million dollars for the eighteen years ending with 1956.

FERRIES AND FERRY SLIPS

With the opening of new tunnels and bridges, some of the ferry routes have become unnecessary. In fact the receipts from the municipal ferries are less than operation and maintenance costs alone.

The expected decline in the rate of population growth and the great increase in bridge and tunnel crossings, either planned or under construction, suggest that future capital expenditures for ferries will be materially less than in the past.

It is not unlikely, however, that the current practice of locating public institutions on islands, along with other increases in public services, such as the use of barges for disposal of sewage residue after treatment, may require outlays that will to some extent offset this indicated decline in ferry expenditures.

⁽¹⁶⁾ The plan for North Beach has been revised since this study was completed; enlarged facilities will increase the amount of investment shown in this tabulation.

Past Expenditures for Ferries

Staff analysis of the Comptroller's reports show that during 1924-36 nearly \$20,000,000 was spent on ferries; the average annual outlay was 1.4 million dollars, but in recent years the amounts have averaged less than one-quarter million dollars.

Prior to 1938, ferries were under the jurisdiction of the now defunct Department of Plant and Structures; the charter transferred ferries to the Dock Department. The staff was unable to determine from available material the extent of the city's investments in ferries still operating.

Future Ferry Outlays

For service to institutions now being located or expanded on islands, it may be necessary to continue the recent annual average ferry outlays at least for the immediate future. But it seems that additional bridges and tunnels will permit progressive reductions in such ex-

penditures at the end of each six-year period.

Consequently staff estimates for ferries and ferry slips are based on this outlook. For the first 6-year period, ferry outlays of 1.7 million dollars are proposed; for the six years, 1945-50, only 1.6 million dollars; and for the third 6-year period, the allowance is only 1.4 million dollars.

DESIRABLE DOCK IMPROVEMENTS

The probable costs of desirable capital improvements under the jurisdiction of the Dock Department are summarized in Table 53 according to the three 6-year periods. During the six years 1939-44, the suggested program totals 23.6 million dollars; for the second period expenditures of 24.8 million dollars are indicated; and during the six years 1951-56 the program calls for expenditures of nearly 26 million dollars. On this basis capital outlays of 74.25 million dollars will be needed for dock projects by the year 1956.

TABLE 53
Costs of Desirable Dock Improvements
(Figures in Millions of Dollars)

Improvement	1939-44	1945-50	1951-56	18-Year Total
Docks and Bulkheads	15.45	15.45	15.45	46.35
Airports	6.45	7.75	9.00	23.20
Ferries	1.70	1.60	1.40	4.70
Totals	23.60	24.80	25.85	74.25

Protection

The future needs of the Police, Fire and Correction Departments, and the Armory Board for permanent improvements are dealt with in this section. It is difficult to predict the magnitude of the demand for such improvements, particularly when so much depends upon future social trends. Changes in the size and distribution of population, in crime rates and in the number and extent of fires will, among other things, be significant.

The staff found it necessary, however, to base its estimates on past per capita expenditures. Since protection facilities may be expected to relate directly to population, this method is believed to furnish a reasonable indication of future needs for this type of project.

The use of per capita factors to determine the amount of expenditures that will probably cover future needs presupposes that the balances of appropriations required to complete projects in the

1937 Capital Outlay Budget are included. This method is also assumed to provide sufficient outlays to meet minimum needs for new projects, depreciation and contingencies. For each Department of the Protection group the staff attempted to determine the proportion of indicated outlays that may be needed to take care of depreciation. This is believed to be of particular interest since the facilities of these Departments are generally housed in comparatively old quarters, particularly in the built-up sections of the city.

POLICE DEPARTMENT

During the thirteen years 1924-36, capital expenditures for Police projects averaged 6 cents per capita per year. On the basis of the population growth predicted by the Mayor's Committee staff, this past average outlay indicates expendi-

tures of \$2,850,000 for the 6-year period 1939-44; \$3,000,000 during 1945-50; and \$3,150,000 for the 6 years 1951-56. The eighteen-year program would then total \$9,000,000.

Although the city pattern envisaged in the Residential Area Study would call for some new police stations and extension of the telegraph and traffic light systems, the expected decrease in the rate of population growth suggests that some of this \$9,000,000 will also be needed for replacements. The 1938 assessed value of Police central offices, precinct station-houses, garages, shops and the telegraph system was approximately 10.25 million dollars, excluding land. If a 3 percent depreciation rate is assumed sufficient to take care of necessary replacements, outlays of 5.5 million dollars are indicated for obsolescence during the eighteen years ending with 1956. While this allowance would not provide for depreciation of any projects undertaken subsequent to 1938, it would leave only 3.5 million dollars available for new projects.

FIRE DEPARTMENT

During the period 1924-36 inclusive, an average of 10 cents per capita per year was expended for administration, hook and ladder, and engine buildings, garages, training schools, fireboats, and the fire alarm telegraph system. This past annual average suggests that capital expenditures for needed Fire Department projects would be \$4,750,000 in the six years 1939-44; for the second 6-year period \$5,000,000; and during 1951-56 about \$5,230,000; or an eighteen-year total of \$14,980,000.

As is the case with Police projects, new improvements for the Fire Department will depend upon the direction of future city development, but it will also be necessary eventually to replace obsolete buildings. In 1938, Fire Department properties were assessed at about 12.3 million dollars, excluding land. If the depreciation factor is again based on replacement of the existing plant in 33 years, at least 6.5 million dollars would be needed during eighteen years to keep the physical plant of the Fire Department up to date. While this allowance does not cover any investment that may be made after 1938, it would leave about 8.4 million dollars for all new projects, including extension of the fire alarm telegraph system.

CORRECTION DEPARTMENT

This agency is charged with the operation and maintenance of institutions for the care and custody of felons, misdemeanants, and violators of ordinances or local laws, and for the detention of

witnesses. Its buildings include prisons, penitentiaries, farms, houses of detention and reformatories.

The annual average expenditures for capital improvements under the jurisdiction of the Department of Correction was equivalent to 13 cents per capita during the years 1924-36 inclusive. Assuming that such an outlay will provide for future needs, the expected population indicates expenditures of \$6,180,000 during the first 6-year period; \$6,500,000 during the second; and \$6,800,000 for the third 6-year period. On this basis \$19,480,000 would be required over the eighteen years 1939-56.

If the 3 percent depreciation factor is assumed to be sufficient, about 9.5 million dollars would be required over eighteen years to take care of normal replacements. This estimate is based on the 1938 assessed value of 17.5 million dollars for Correction properties exclusive of land. If it should be necessary to make replacements at this rate, there would be slightly less than 10 million dollars of the eighteen-year program available for new projects.

ARMORIES

There are over twenty National Guard and Naval Militia armories in New York City, which in 1938 were assessed at 10.5 million dollars not including land value. In the thirteen years 1924-36, city expenditures for armories averaged just one cent per capita per year. On this basis future capital outlays would amount to \$490,000 during the first 6-year period 1939-44; \$500,000 the second period; and \$520,000 during 1951-56; the eighteen-year total would then aggregate \$1,510,000.

Insomuch as no actual expansion in the number of armory buildings seems necessary, the staff estimate presumably provides for obsolescence, and does not include new buildings. If, however, obsolescence is figured at 1 percent of the 10.5 million dollars assessed value, almost 2 million dollars would be needed for replacements over eighteen years. But the staff estimate of \$1,510,000 indicates that armory facilities would be *completely* replaced once every 128 years. While such a low rate of depreciation may not appear to be sufficient, past outlays indicate that an allowance of \$1,510,000 will cover such needs.

COST OF DESIRABLE PROTECTION IMPROVEMENTS

Table 54 summarizes by agency and six-year periods the \$44,970,000 of capital expenditures

indicated by these estimates as necessary for permanent Protection improvements. The suggested program calls for outlays of \$14,270,000 the first 6-year period; \$15,000,000 the second; and \$15,700,000 the third period, ending in 1956.

The employment of per capita outlays may be supposed to indicate minimum expenditures that will be required for the most urgently needed

improvements, especially since the replacement needs of these agencies appear to be so large in relation to the total allowances. Hence the figures in Table 54 are certainly on the conservative side, and will probably not permit any large scale expansion of Protection facilities beyond the more urgent needs for such services.

TABLE 54
Costs of Desirable Protection Improvements
(Figures in Millions of Dollars)

Agency	1939-44	1945-50	1951-56	18-Year Total
Police	2.85	3.00	3.15	9.00
Fire	4.75	5.00	5.23	14.98
Correction	6.18	6.50	6.80	19.48
Armories	0.49	0.50	0.52	1.51
Totals	14.27	15.00	15.70	44.97

Health

Under the general heading of "Health," this report discusses the probable needs of the Departments of Hospitals, Health and Welfare for permanent improvements necessary to carry on these public services during the eighteen years 1939-56 inclusive. These facilities include hospitals, dispensaries, nurses' homes, staff quarters, auxiliary hospital buildings, health centers and laboratories, public welfare buildings and camps.

The needs for such facilities will be determined by a number of factors. The geographic distribution, age and racial characteristics of the popu-

lation; the sickness, birth, mortality and accident rates are all of significance. The effectiveness of health programs, and the extent of hospital building in other parts of the metropolitan region will affect hospital needs in New York City. In addition, the requirements for "Health" facilities should be predicated upon such considerations as social acceptability of ward care and of relief, official policy in regard to the maintenance of public charges in voluntary or proprietary hospitals, the popularity of preventive health measures, the length of quarantine periods, and gains

TABLE 55
Hospital Construction
Beds Provided in 24 Municipal and 6 Other Governmental, 25 Proprietary and 100 Voluntary Hospitals in New York City
(From Hospital Survey of New York)

Decade	Population at End of Period	Total New Beds Provided	Beds Provided Governmental	Percent Governmental of Total Beds
1860-69	1,478,103	4,771	424	8.89
1870-79	1,911,698	2,336	1,367	58.52
1880-89	2,507,414	5,519	1,637	29.66
1890-99	3,437,202	6,982	4,953	70.94
1900-09	4,766,833	3,304	928	28.09
1910-19	5,620,048	8,578	6,111	71.24
1920-29	6,930,446	4,167	2,129	51.09
Totals	....	35,657	17,549	49.21

in group or government medicine, as well as the income level of the city's inhabitants and employment conditions in New York.

HOSPITAL DEPARTMENT

For the purpose of this study, however, certain quantitative standards were employed as a basis for determining the future hospital program. Reports of the 1935 Hospital Survey, recently published by the United Hospital Fund, were made available to the staff and have furnished considerable information and guidance.

Present Hospitals and Future Needs

The Hospital Survey classes institutions for the care of the sick as general, mental, tuberculosis,

have built and maintained hospitals in New York City.

The Mayor's Committee staff estimates of new facilities required in the future are based on the standards and costs per bed employed in the Hospital Survey. But the staff population figures (as given in the Population Report) are lower than the forecasts of future population used in the Hospital Survey.

General hospitals contained 33,687 beds in 1934 and 1,507 additional beds were provided during 1935-8. The staff estimated that hospitals now under construction will add 1,346 more beds; hence there will be 36,540 beds shortly available. The accompanying tabulation shows the new beds that will be needed by the first of the year 1957.

This estimate is based on 4.55 beds per thou-

New Beds Needed in General Hospitals

<u>6-Year Period</u>	<u>Total Beds Required</u>	<u>Beds Available</u>	<u>New Beds Needed by End of Period</u>	<u>Cost of New Beds</u>
1939-44	36,890	36,540	350	\$ 3,290,000
1945-50	38,770	36,890	1,880	17,672,000
1951-56	40,130	38,770	1,360	12,784,000
Totals for eighteen years			3,590	\$33,746,000

and acute communicable disease hospitals, convalescent homes and hospitals for the chronically ill. While there was a total of 49,465 beds in all proprietary, voluntary and governmentally controlled hospitals in New York City, the entire plant was found to be 28 percent depreciated in 1934. Table 55, showing hospital construction by decades for 155 of the 208 institutions in New

sand of population with construction, equipment and land costs of \$9,400 per bed.

Hospitals for mental patients provided 10,146 beds in 1934 but apparently there are no additional facilities built or under construction in New York City. The accompanying estimate of future needs allows for 1.5 beds per thousand of population with the cost at \$5,500 per bed.

New Beds Needed in Hospitals for Mental Patients

<u>6-Year Period</u>	<u>Total Beds Required</u>	<u>Beds Available</u>	<u>New Beds Needed by End of Period</u>	<u>Cost of New Beds</u>
1939-44	12,175	10,146	2,029	\$11,160,000
1945-50	12,780	12,175	605	3,328,000
1951-56	13,230	12,780	450	2,475,000
Totals for eighteen years			3,084	\$16,963,000

York City, not only suggests the age of existing facilities but also indicates the relation of governmental construction to total beds provided. It should be mentioned, however, that only a part of the governmental hospitals were built by the city; both the Federal and State Governments

The comparatively large number of beds needed in the first period shows that this desirable standard of 1.5 beds per thousand of population is apparently not being maintained, unless additional hospitals outside of the city are taking care of the 1938 load. It may be that hospitals not

classed as "mental" provide beds in some cases. At any rate the standard continues the present tendency of providing nearly three-quarters of the beds for mental cases outside of New York City.

Tuberculosis and Acute Communicable disease hospitals are considered as a group only for convenience of presentation; they are not necessarily interchangeable facilities. The Hospital Survey reports 5,632 beds available in 1934, of which 4,648 were in tubercular and 984 in acute communicable disease hospitals. Unless erroneously included by the staff, under "general" hospitals there are no facilities in addition to those now building. On the basis of 0.88 "tuberculosis" beds and 0.12 "acute" beds per thousand of population and with costs of \$6,000 per bed, future construction needs will be as shown in the tabulation.

This tabulation suggests that new buildings

year 1944. According to Hospital Survey standards there should be 0.9 beds per thousand of population; new beds are estimated at \$5,500 each. On this basis future requirements would be as shown in the tabulation.

Here again it would seem that the needs of the immediate future will not be met by current construction, and it is apparent that the desirable standard of 0.9 beds is not being maintained.

Miscellaneous Buildings such as nurses' residences, dispensaries, staff quarters, power plants, etc., generally represent about 9 percent of the total investment in all hospital facilities. On this past average the Mayor's Committee staff based its estimates of future expenditures that may be required for "miscellaneous" buildings.

Table 56 summarizes the total expenditures indicated by the foregoing estimates for the several

New Beds Needed in Hospitals for Tuberculosis and Acute Communicable Diseases

6-Year Period	Total Beds Required	Beds Available	New Beds Needed by End of Period	Cost of New Beds
1939-44	8,108	5,632	2,476	\$14,856,000
1945-50	8,520	8,108	412	2,472,000
1951-56	8,824	8,520	304	1,824,000
Totals for eighteen years			3,192	\$19,152,000

necessary to provide the desirable bed capacity is not keeping pace with needs; or the possibility that patients may be cared for either in "general" hospitals or in other institutions within the city.

Convalescent homes provided 3,597 beds at the end of 1934. In so far as the staff can determine there are no new beds being provided, unless under "general" hospitals. Based on one-half bed per thousand population and a construction cost of \$4,800 per bed, future needs are estimated as shown in the tabulation.

Hospitals for the chronically ill contained 2,569 beds in 1934; the new Welfare Island Hospital will provide 1,600 additional beds prior to the

types of hospitals, and shows the amounts that will be needed for "miscellaneous" buildings during the eighteen years.

Municipal Expenditures for Hospitals

Capital outlays by the city for Hospitals must provide not only for new facilities needed by the expected population growth, but also for the completion of hospitals under construction, and for obsolescence of the hospital plant.

New facilities will require expenditures as shown in Table 56, but the ratio of municipal to total investment in all hospital facilities was about 31 percent according to the Hospital Survey. As-

New Beds Needed in Convalescent Homes

6-Year Period	Total Beds Required	Beds Available	New Beds Needed by End of Period	Cost of New Beds
1939-44	4,054	3,597	457	\$2,194,000
1945-50	4,260	4,054	206	990,000
1951-56	4,412	4,260	152	730,000
Totals for eighteen years			815	\$3,914,000

suming that a similar ratio will hold in the future, the city need expend only 16.3 million dollars the first 6-year period, 8.86 million the second, and 6.45 million dollars during the third 6-year period. The remaining needs will presumably be provided by funds from other governmental and private sources.

While the need for hospitals and auxiliary facilities, being based on a slower rate of population growth, is less than the requirements given in the Hospital Survey, there can be little doubt of the urgency of such needs. However, the Hospital Survey concluded that bed vacancies of 15 percent must be allowed to take care of transfers, emergencies, the winter peak, cleaning and repairs, but it showed that actual vacancies varied from zero in city hospitals to 60 percent and more in

levels. At any rate the more efficient use of present facilities will reduce the amount of money that the city would otherwise be called upon to expend for hospitals.

On this assumption the staff shifted the outlays for new hospitals between 6-year periods, as shown in Table 57, but the eighteen-year total was slightly increased; it seems that current trends will probably result in a larger proportion of municipal expenditures for hospitals. Accordingly the ratio of city expenditures was increased to about one-third of the total costs given in Table 56.

Completion of Hospitals for which partial authorizations were contained in the 1937 Capital Outlay Budget will require capital expenditures of 5.66 million dollars, according to staff analyses,

New Beds Needed in Hospitals for the Chronically Ill

<u>6-Year Period</u>	<u>Total Beds Required</u>	<u>Beds Available</u>	<u>New Beds Needed by End of Period</u>	<u>Cost of New Beds</u>
1939-44	7,300	4,169	3,131	\$17,220,500
1945-50	7,660	7,300	360	1,980,000
1951-56	7,940	7,660	280	1,540,000
Totals for eighteen years			3,771	\$20,740,500

some proprietary and voluntary hospitals. Accordingly the Survey suggested two substitutes for a large building program: the use for ward service of some of the unused facilities now assigned to private service in voluntary hospitals that care for public charges; and the use for public charges of more of the properly equipped, suitably organized and partially unoccupied voluntary hospitals. It might also be possible to move patients to hospitals operated by other government

to provide the additional beds in municipal hospitals assumed as available in this study.

Obsolescence—The entire Hospital plant was 28 percent depreciated in 1934 according to the Hospital Survey. It might be expected that considerable expenditures will be necessary to keep the municipal hospitals up-to-date. Since land does not depreciate and the Charter apparently permits the expenditure of capital funds for equipment in buildings only when first constructed, but

TABLE 56
Estimated Costs of All Needed New Voluntary, Proprietary and Governmental Hospitals and Miscellaneous Buildings
(Figures in Millions of Dollars)

Facility	1939-44	1945-50	1951-56	18-Year Total
General	3.290	17.672	12.784	33.746
Mental	11.160	3.328	2.475	16.963
Tubercular & Acute	14.856	2.472	1.824	19.152
Convalescent	2.194	0.990	0.730	3.914
Chronic	17.220	1.980	1.540	20.740
Totals—	48.720	26.442	19.353	94.515
Miscellaneous—	4.730	2.608	1.897	9.235
Grand Total—	53.450	29.050	21.250	103.750

TABLE 57
Estimated Municipal Expenditures for Hospitals
(Figures in Millions of Dollars)

Facility	1939-44	1945-50	1951-56	18-Year Total
Old projects	5.66	....	....	5.66
New projects	7.81	13.35	13.10	34.26
Obsolescence	11.30	12.70	14.05	38.05
Totals —	24.77	26.05	27.15	77.97

excludes replacements or repairs, the staff based its obsolescence estimates on the investment in buildings alone. While the investment in municipal hospitals was about 120 million dollars, the net for buildings was over 86 million, and with additional expenditures since 1935 the building investment is estimated at 94.4 million dollars as of 1939.

For the purpose of this study the useful life of hospital buildings is taken at 50 years. On the 94.4 million dollar investment in city hospital buildings this depreciation factor would call for \$11,300,000 during the first 6-year period.

During the first 6-year period the capital outlays given in Table 57 would add 13.47 million dollars, but buildings alone would account for only 11.45 million dollars. Hence the investment in buildings would total 105.85 million dollars by 1945 and, at 2 percent, \$12,700,000 would be required during the second 6-year period for obsolescence.

During the second 6-year period the expenditure shown in Table 57 would add 13.1 million dollars to the hospital investment, but, excluding land and equipment, only 11.35 million dollars would go for buildings. On this basis the cumulative building investment would amount to 117.2 million dollars by 1951 and the 2 percent depreciation allowance would call for outlays of \$14,050,000 in the 6 years 1951-56.

The Suggested Capital Program for Hospitals, that will presumably meet the indicated needs, is summarized in Table 57.

Old, new and obsolescence hospital projects will require outlays of nearly 25 million dollars the first 6-year period. During the second and third periods new and obsolescence projects call for total expenditures of about 26 and 27.1 million dollars, making an eighteen-year program of approximately 78 million dollars for Hospitals.

HEALTH DEPARTMENT

General health facilities are not subject to a similar analysis. They cannot be related so

directly to populations, to number of beds or to other tangible units. Much depends upon the amount of service demanded. Specifically, how far shall the city go in providing clinics, analytical laboratories, and preventive medicine campaign offices and equipment? The types of health buildings needed are not entirely standardized. In New York there are four types: Health centers, baby health centers, laboratories, and administrative quarters.

The recent building program has brought the health facilities more up-to-date than they had ever been before. With the WPA the department is now working on 12 new baby health stations which are at various stages of construction; two other new ones had been provided by the fall of 1937, and another was provided through a remodeling job. In the three prior years 10 others had been provided with new quarters. The program is a continuing one, which should have as its aim the supply of city-owned buildings for as many of the baby health centers as will benefit thereby.

Eleven new general health centers had recently been built, or were building in September, 1937, and two new district centers had been provided through renovation of old buildings. The research laboratories have been provided recently with a new building and with a renovation of an old one. In 1935, with the opening of the new municipal building for the Departments of Hospitals, Sanitation and Health, new quarters were provided for administrative work.

The 19 cents per capita spent in 1936 on health facilities cannot continue without unnecessarily penalizing other programs. If the per capita investment of the city, both in lean years and in the recent "health boom," be averaged, an index is obtained which appears reasonable. On this basis, about 3 cents per capita seems necessary for each of the next eighteen years. This per capita index indicates outlays of \$1,430,000 during the first 6-year period, \$1,510,000 for the second, and \$1,640,000 during the third 6-year period. With

a small amount of Federal or State aid it is believed that these expenditures, which would total \$4,580,000 during the next eighteen years, will take care of necessary expansion and the small amount of obsolescence to be expected prior to 1957.

WELFARE DEPARTMENT

Factors affecting welfare needs must be considered in addition to the general factors affecting health and hospital needs. Insanity and intemperance, divorce, separation and illegitimacy, departmental policies concerning care of dependents by private agencies, and the proportion of costs which relatives will shoulder, are all factors. Institutions not now under control of the Department of Welfare may be placed there, and the Department may be relieved of some of its present duties. In this study all facilities used for the conduct of the Department's present activities are included in the estimate of future needs.

Welfare activities, aside from clerical and administrative work, are chiefly concerned with the housing of blind and dependent children, homeless, and non-settled adults and children, and the operation of a camp for unemployed and homeless men.

The Welfare Department now maintains a store, a laundry, fire apparatus, a chapel, a heating plant, a cannery, hospital equipment, and homes among

its miscellaneous facilities, as well as various home relief offices.

Any sudden increases can probably be made up by boarding more dependents with private institutions, or renting additional administrative quarters. For the rest a construction program calling for annual expenditures of eight cents per capita should be sufficient for future needs. This is the average per capita outlay in the years 1924-1936 and would allow \$3,800,000 during the first 6-year period, \$4,000,000 in the second, and \$4,100,000 for the third 6-year period. Of the eighteen-year totals, amounting to \$11,900,000 about one-half will probably be needed for replacements and reconditioning of depreciated property and the balance for such new construction as may be necessary.

SUGGESTED CAPITAL PROGRAM FOR "HEALTH"

On the basis of this study, future needs for permanent "Health" improvements can be met by the expenditures suggested in Table 58 totaling \$94,450,000 for eighteen years. The nature of this study suggests, however, that such outlays will probably provide for only the most urgent needs. In this sense the suggested program may be considered a minimum schedule for hospital, health and welfare projects.

TABLE 58
Costs of Desirable Health Improvements
(Figures in Millions of Dollars)

Department	1939-44	1945-50	1951-56	18-Year Total
Hospitals	24.77	26.05	27.15	77.97
Health	1.43	1.51	1.64	4.58
Welfare	3.80	4.00	4.10	11.90
Totals —	30.00	31.56	32.89	94.45

Public Buildings and Miscellaneous

This study attempts to ascertain the probable future expenditures required to provide for necessary new and obsolete Markets, Libraries, Museums, Courts, Administrative Buildings and Miscellaneous capital projects during the eighteen years 1939-56, inclusive. Since most of these facilities are directly related to the city's gross population, future needs were predicated upon past average per capita expenditures. Other factors, including administrative policy, will affect the de-

mand for such services, but it was not possible to undertake studies that might indicate the extent of such demands. Consequently the per capita method offered the only reasonable basis, and is believed to reveal the probable expenditures that will cover minimum needs.

In this chapter the total expenditures are considered under each heading and the amounts indicated to cover depreciation of all these facilities are treated as a group at the end of the chapter.

This treatment was necessary because separate figures on each agency for investment or assessed value were not readily available.

MARKETS

In the thirteen-year period 1924-36, an average of 20 cents per capita was expended upon markets each year. This past average outlay indicates that 9.5 million dollars will be needed during the 6-year period 1939-44; for the second 6-year period 10 million dollars will be required; and in the six years 1951-56 market needs will call for 10.4 million dollars of capital funds. On this basis the eighteen-year total would be \$29,900,000 for both new and replacement projects to take care of obsolescence.

LIBRARIES

Libraries, including the Brooklyn, Queens and New York Public Libraries and their branches, received outlays of city funds for permanent improvements that averaged 4.2 cents per capita per year during 1924-36. On this basis future capital expenditures would be as follows: 1.99 million dollars for the six years 1939-44; during the second 6-year period, 2.1 million dollars would be needed; and in the six years 1951-56 outlays of 2.19 million dollars. The eighteen-year allowance that would presumably provide for both new and replacement needs would amount to \$6,280,000 for public libraries.

MUSEUMS

This group includes the American Museum of Natural History, Brooklyn Institute of Arts and Sciences, Metropolitan Museum of Art, New York Botanical Garden, New York Zoological Society and the Staten Island Zoo. During the thirteen years 1924-36, the city expended an average of 9 cents per capita each year for permanent "museum" improvements.

Assuming that this past average will provide for the most urgent needs, for both new and replacement projects, museum expenditures would amount to 4.27 million dollars the first 6-year period; 4.50 million dollars the second; and 4.69 million dollars the third 6-year period; or an eighteen-year total of \$13,460,000.

COURTS

Under this heading are included all court buildings for which the city is required to expend capital funds. In the period 1924-36, permanent

court improvements averaged 20 cents per capita per year. On the supposition that a similar per capita outlay will provide for all court needs, 9.5 million dollars will be called for during the first 6-year period, 10 million dollars the second, and 10.4 million dollars in the third 6-year period. On this basis \$29,900,000 will be required over the eighteen years 1939-56 for Courts.

ADMINISTRATION BUILDINGS

This group comprises all public municipal buildings not elsewhere included in the Mayor's Committee Studies. As nearly as the staff can determine, 21 cents per capita was the annual average expenditure for such projects in the thirteen years 1924-36.

On the assumption that this past average will provide sufficient funds to take care of depreciation and replacements, as well as new projects, the eighteen-year allowance would total \$31,570,000. Of this total, 10-million dollars would be scheduled for the first 6-year period; 10.57 million dollars the second; and 11 million dollars during the third 6-year period.

MISCELLANEOUS PROJECTS

These projects include the several types of capital projects that could not be otherwise classified, as well as some of the authorizations (for personnel engaged in design and supervision of permanent improvements) that were deducted from the expense budget in the Finance Study because they were paid from capital funds. During 1924-36 the city spent an average of 43 cents per capita per year for these miscellaneous improvements.

On this basis the staff estimates that 20.44 million dollars will be needed the first 6-year period; 21.53 million dollars the second; and 22.52 million dollars the third 6-year period. The eighteen-year allowance for miscellaneous projects would then aggregate \$64,490,000.

SUGGESTED CAPITAL PROGRAM

As a result of these estimates, the staff suggests the capital program, summarized in Table 59, for Public Buildings and Miscellaneous projects.

As already mentioned these allowances are presumed sufficient for depreciation and obsolescence and for new projects that may be required as a result of the city's expected growth.

Staff analyses indicate that the 1938 assessed value of city properties enumerated in Table 59

was nearly 88 million dollars exclusive of land. If a depreciation factor of 2.5 percent is considered ample to cover all obsolescence and replacements, the entire plant could be rebuilt or partially relocated once every forty years. At this rate approximately 40 million dollars will be required during the next eighteen years for de-

preciation, and about 135 million dollars would remain for new projects. Compared with the relatively greater obsolescence of other groups of structures, the 40 million dollar allowance for depreciation of Public Buildings and Miscellaneous projects is small, but the obsolescence rate is believed conservative.

TABLE 59
Costs of Desirable Public Buildings and Miscellaneous Projects
(Figures in Millions of Dollars)

Facility	1939-44	1945-50	1951-56	18-Year Total
Markets	9.50	10.00	10.40	29.90
Libraries	1.99	2.10	2.19	6.28
Museums	4.27	4.50	4.69	13.46
Courts	9.50	10.00	10.40	29.90
Administration	10.00	10.57	11.00	31.57
Miscellaneous	20.44	21.53	22.52	64.49
Totals —	55.70	58.70	61.20	175.60

